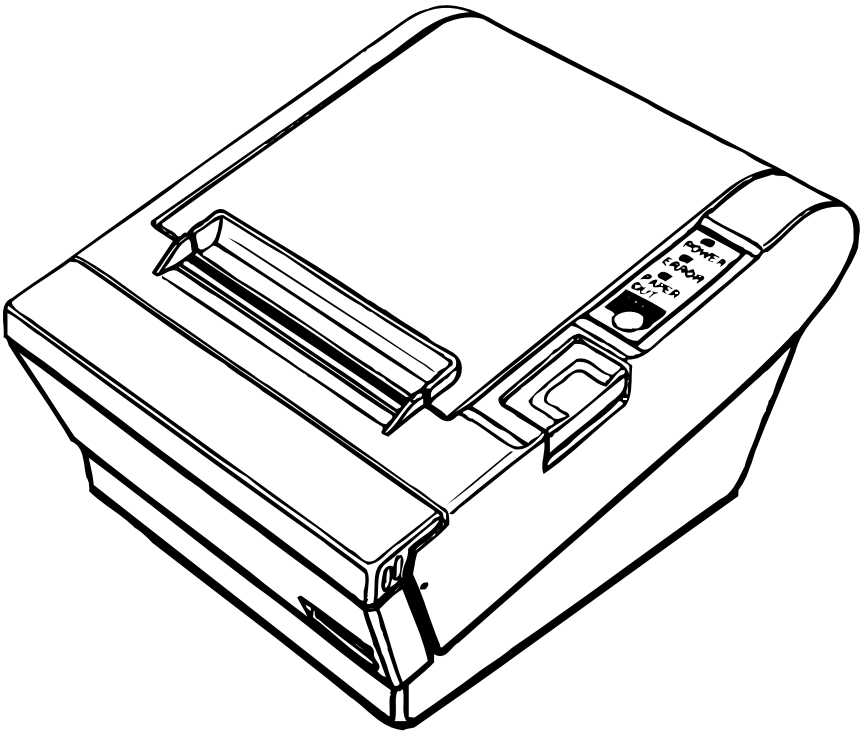
TECHNICAL MANUAL

(without price)

UP-350
TM-T88 Series

FEB. 1997



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CASIO®

FCC CLASS A

FCC Compliance Statement

For American Users

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

WARNING

The connection of a non-shielded printer interface cable to this printer will invalidate the FCC Verification of this device and may cause interference levels which exceed the limits established by the FCC for this equipment.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

FOR CANADIAN USERS

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment regulations.

Cet appareil numérique de la classe A respecte toutes les exdgences du Règlement sur le matériel brouilleur du Canada.

GEREÄUSCHPEGEL

Gemäß der Dritten Verordrung zum Gerätesicherheitsgecsetz (Maschinenlärminformations- Verordnung-3. GSGV) ist der arbeitsplatzbezogene Geräusch-Emissionswert kleiner als 70 dB(A) (basierend auf ISO 7779).

Modular type connectors

You see the following caution label near the modular type connectors on the back panel of the product.

Caution:

The product uses a modular type connector exclusively for the cash drawer. Never plug a telephone line into this connector.

Introduction

The TM-T88 (RS-232 serial interface specification)[1] and the T88P (parallel interface specification) are line printers that can print on a paper roll. The printer has the following features:

Printing

- ❑ High speed printing approximately 16.5 lines/second (1/6 inch feed).
- ❑ Low-noise thermal printing.
- ❑ High reliability due to a stable mechanism.

Application Software

- ❑ Command protocol is based on the ESC/POS™ standard.
- ❑ Various layouts are possible by using page mode.
- ❑ Characters can be scaled up to 64 times as large as the standard size. Smoothing is also possible.
- ❑ Bar code printing is possible by using a bar code command. Bar codes can be printed both in the vertical direction (fence bar code) and in the horizontal direction (ladder bar code)[2].
- ❑ Repeated operation and copy printing are possible by using macro definitions.
- ❑ Character font size (12 x 24 font or 9 x 24 font) can be selected using a command.

Printer Handling

- ❑ Easy paper roll setting.
- ❑ Equipped with an auto-cutter.
- ❑ Easy maintenance for tasks such as head cleaning.
- ❑ Four different print densities selectable by DIP switches.
- ❑ Built-in interface provides control capability for two drawers.

[1]RS-485 serial interface is a dealer option.

[2]Effective in page mode

Warnings, Cautions and Notes

⚠ *WARNING:*

Warnings must be followed carefully to avoid bodily injury.

⚠ *CAUTION:*

Cautions must be observed to avoid damage to your equipment.

Note:
Notes have important information and useful tips on the operation of your printer.

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Chapter 1
Features and General Specifications

Printer Parts

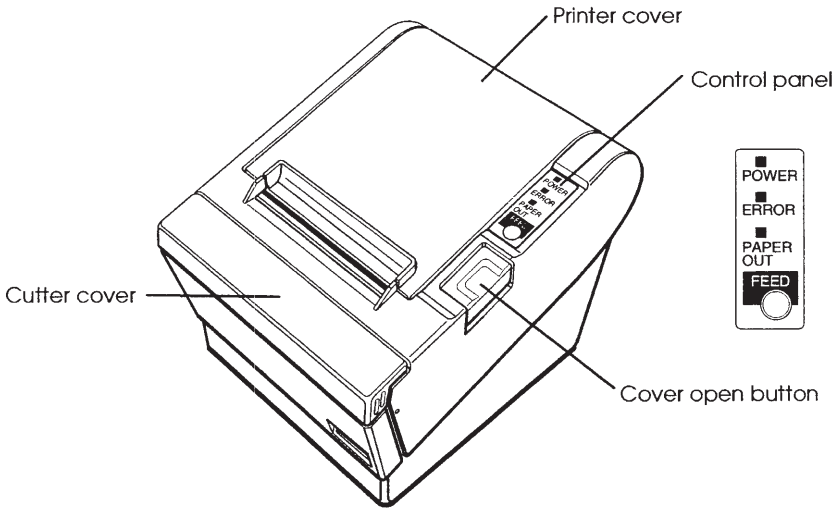


Figure 1-1 TM-T88 appearance

Printing Specifications

Printing method:	Thermal line printing
Dot density:	180 dpi × 180 dpi. The number of dots per 25.4 mm (1")
Printing direction:	Unidirectional with friction feed
Printing width:	72 mm (2.83"), 512 dot positions
Characters per line:	42 (font A)
	56 (font B)
Character spacing:	0.28 mm (.01") (2 dots) (font A)
	0.28 mm (.01") (2 dots) (font B)
	Programmable by control command.
Printing speed:	
High speed:	Approximately 16.5 lines/second (1/6 inch feed) (at 24V, 20°C, Density level 2)
	Approximately 2.76 inches/second (approximately 70 mm/second)
Low speed:	Approximately 11.8 lines/second (1/6 inch feed)
	Approximately 2.0 inches/second (approximately 50 mm/second)
	High and Low speeds are switched automatically depending on the voltage applied to the printer and the environment temperature.
	Approximately 1.1 inches/second (approximately 28 mm/second) when a ladder bar code is printed.

Notes: *Printing speed may be slower depending on the data transmission speed and the combination of control commands.*

The printer switches the mode of the printing speed automatically.

There may be variations in printing after switching the mode of the printing speed. To prevent this for logo printing, using a downloaded bit image is recommended.

Paper feed speed: Approximately 2.76 inches/second (approximately 70 mm/second) (continuous printing)

Line spacing: 1/6 inch (4.23 mm)
Programmable by control command

Character Specifications

Number of characters:

Alphanumeric characters: 95

Extended graphics: 128 × 7 pages (including one space page)

International characters: 32

Character structure: 12 × 24 (font A) (including 2-dot spacing in horizontal)

9 × 24 (font B) (including 2-dot spacing in horizontal)

Font A is selected as the default

Character size:

	Standard		Double-height		Double-width		Double-width/ Double-height	
	W × H (mm)	CPL	W × H (mm)	CPL	W × H (mm)	CPL	W × H (mm)	CPL
Font A 12 × 24	1.41 × 3.39 (.06" × .13")	42	1.41 × 6.77 (.06" × .27")	42	2.82 × 3.39 (.11" × .13")	21	2.82 × 6.77 (.11" × .27")	21
Font B 9 × 24	0.99 × 3.39 (.04" × .13")	56	0.99 × 6.77 (.04" × .27")	56	1.98 × 3.39 (.08" × .13")	28	1.98 × 6.77 (.08" × .27")	28

Space between characters is not included.

Characters can be scaled up to 64 times as large as the standard sizes.

CPL = Characters per line

Auto Cutter

Partial cut: Cutting with one point left uncut (selectable by GS V)

Note:
To prevent dot displacement, after cutting, paper must be fed approximately 1 mm (14/360 inches) or more before printing.

Paper Roll Supply Device

Supply method: Drop-in paper roll

Near-end sensor

Detection method: Microswitch

Paper roll spool diameter: Inside: 12 mm (.47")

Outside: 18 mm (.71")

Near-end adjustment: Adjusting screw

Remaining amount: Fixed position #1 (approximately 23 mm (0.9"))

#2 (approximately 27 mm (1.06")

(The adjusting screw has two positions.)

Note:
You can use a command to stop printing upon detection of a paper near-end.

Paper Specification

Paper type: Specified thermal roll paper, NTP080-80

In Japan: Nakagawa, Seisakujo

In U.S.A.: Nakagawa Mfg. (USA) Inc.

In Europe: Nakagawa Mfg. (Europe) GmbH

In Southeast Asia: N.A.K. Mfg. (Malaysia) SDN BHD

Original paper: TF50KS E Nippon Paper Industries Co.,Ltd.

The following paper can be used instead of the specified paper above:

Original paper: PD 160R New Oji Paper Mfg. Co. Ltd.

Original paper: AF50KS-E Jujo Thermal Oy (Finland)

Original paper: F380 Kanzaki Specialty Papers, Inc. (U.S.A.)

Form: Paper roll

Paper width: 79.5 ±0.5 mm (3.13" ± 0.02")

Paper roll size:

Roll diameter:	Maximum 83 mm
Take-up paper roll width:	80 + 0.5/-1.0 mm (3.15" + 0.02"/-0.04")
Paper roll spool diameter:	Inside: 12 mm (.47")
	Outside: 18 mm (.71")

⚠ CAUTION

Paper must not be pasted to the paper roll spool.

Printable Area

Paper roll

The printable area of a paper with width of 79.5 ± 0.5 mm (3.13" ± 0.02") is 72.2 ± 0.2 mm (2.84" ± 0.008") (512 dots) and the space on the right and left sides are approximately 3.7 mm (0.146").

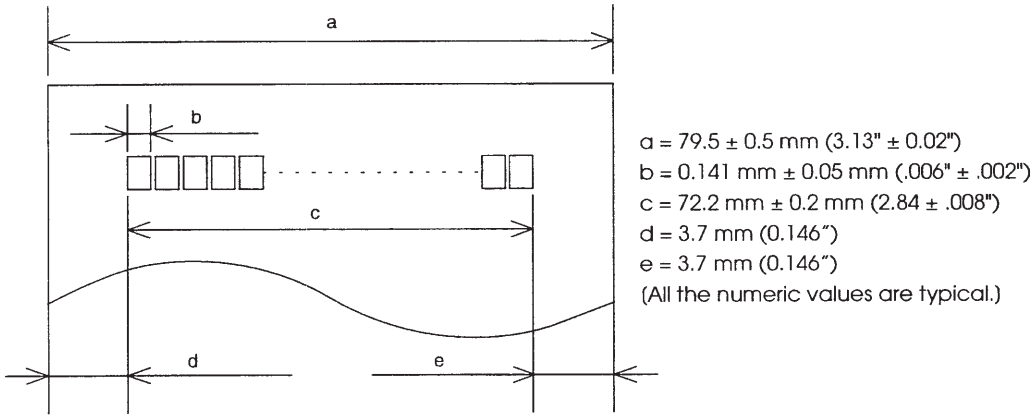

a
b
c
d
e
a = 79.5 ± 0.5 mm (3.13" ± 0.02")
b = 0.141 mm ± 0.05 mm (.006" ± .002")
c = 72.2 mm ± 0.2 mm (2.84 ± .008")
d = 3.7 mm (0.146")
e = 3.7 mm (0.146")
(All the numeric values are typical.)

Figure 1-2 Printable area

Note:
The print position within the printable area of the thermal elements for dots 257 to 512 is shifted approximately 0.07 mm (.003") in the paper feed direction from the position for dots 1 to 256. Be sure not to print a ladder bar code across both printable areas, as this can cause variations in printing which are difficult to read.

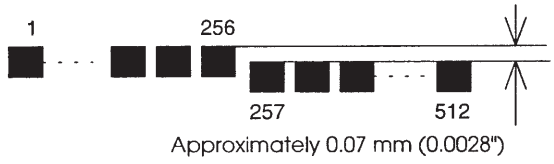


Figure 1-3 Shifting of the print position

Printing and Cutting Positions

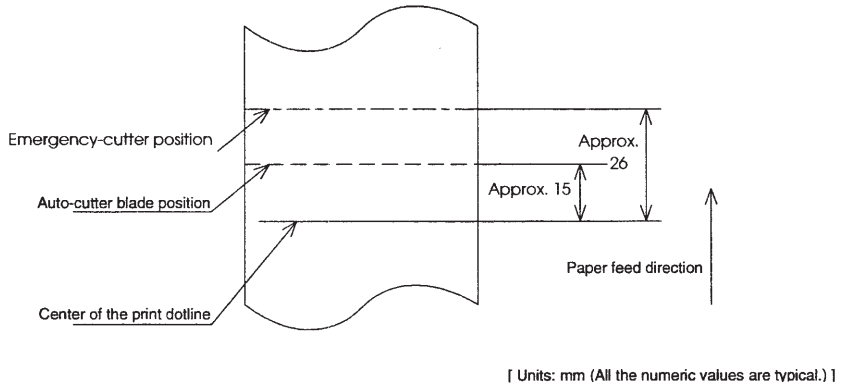


Figure 1-4 Printing and cutting positions

Note:
Numeric values used here are typical values; the values may vary slightly as a result of paper slack or variations in the paper.

Internal Buffer

Receive buffer selectable as 45 or 4K bytes using the DIP switch.

Electrical Specifications

Supply voltage: +24 VDC ± 7% (optional power supply: PS-170)

Current consumption (at 24V, normal temperature)

Operating:
Mean:
Approximately 1.5A
(Character font A α-N, capital letters, 36-character rolling pattern, 42 column printing)

Peak:
Approximately 5.0A

Standby:
Mean:
Approximately 0.2A

Note:
Maximum 1A for drawer kick-out driving.

EMI and Safety Standards Applied (EMC is tested using the PS-170 power supply)

Europe:	CE marking:	EN55022 EN50082-1 EN45501
	Safety Standard:	TÜV (EN60950)
North America:	EMI:	FCC Class A
	Safety standards:	UL1950-2TH-D3 C-UL
Japan:	EMI:	VCCI Class 1

Conditions of acceptability

1. This component has been judged on the basis of the required spacing in the Standard for Information Technology Equipment, including Electrical Business Equipment, UL 1950 and CSA22.2 No. 950. sub-clause 2.9, which would cover the component itself if submitted for Listing.

2. This unit is intended to be supplied by a SELV circuit only.

3. The terminals and connectors have not been evaluated for field wiring.

Reliability

MCBF: Mechanism: 10,000,000 lines (Life: 15,000,000 lines)
(when printing with font A; Print density level 2)
(when performing autocutting once each for every 10 lines printed)
(Based on the test patterns shown below.)

Print head life: 100 million pulses, 100 km

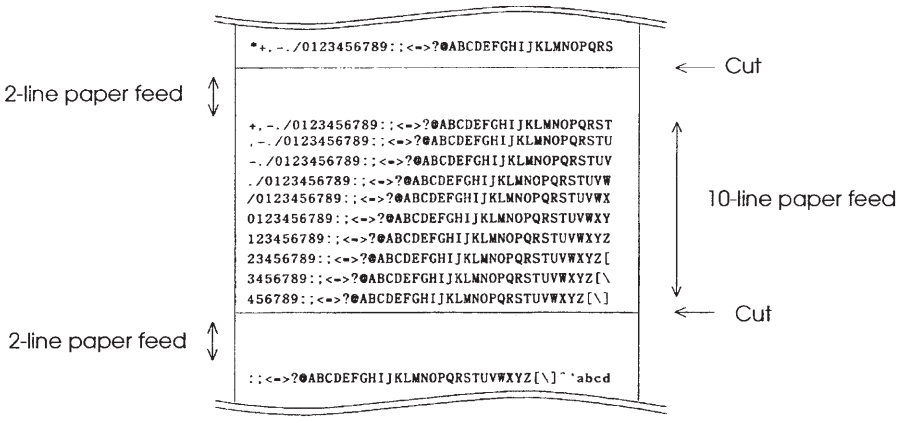


Figure 1-5 Printing pattern

Acoustic noise:

Operating:	Approximately 55 dB (Bystander position)

External Dimensions and Weight

Height:	Approximately 148 mm (5.83")
Width:	Approximately 145 mm (5.71")
Depth:	Approximately 195 mm (7.68")
Weight:	Approximately1.8 kg (3.96 lbs) (excpet for the paper roll)

Environmental Conditions

Temperature:

Operating:	5° to 45°C (41° to 113°F)
Storage:	–10° to 50°C (14° to 122°F) (except for paper)

Humidity:

Operating:	10 to 90% RH
Storage:	10 to 90% RH (except for paper)

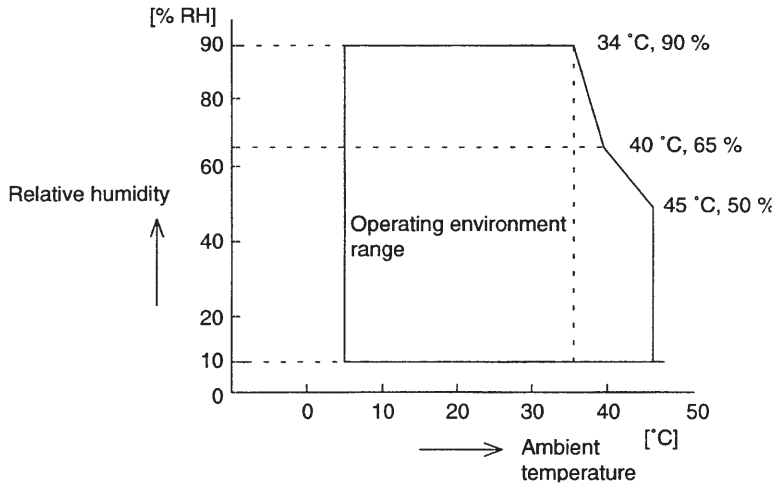


Figure 1-6 Operating temperature and humidity range

Major Component Specifications

M-T88 Printer Mechanism

Paper Feed Motor

Type: 4-phase, 48-polarity, PM type stepping motor

Drive Voltage: 24 V DC ± 10%

Winding resistance: 90 Ω ± 7% at 25° C (77° F), per phase

Print Head Unit

Dot number: 512 dots

Dot density: 0.141 mm/dot (180 DPI)

Resistance: Average 865 Ω ± 4.6%

Paper-end Sensor

Type: Reflection type photo sensor

Paper Roll Near-end Sensor

Type: Microswitch

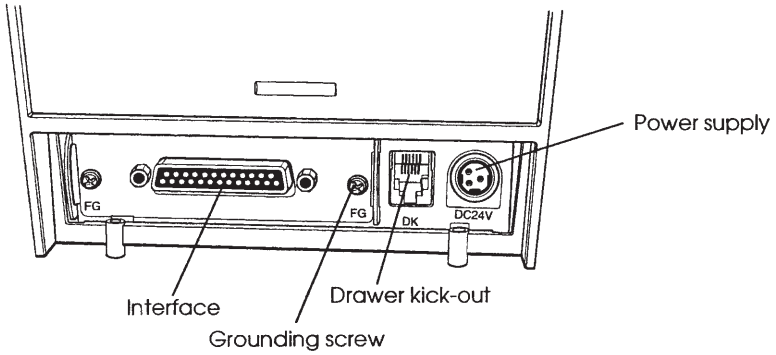
Auto-cutter Unit

Type: DC brush motor

Cutter motor voltage: 24 V DC ± 7%

Current consumption: 700 mA peak (at starting, low temperature)
70 mA average (room temperature)

Connectors



(*) The shape of the interface connector is different from the illustration above if the printer has a parallel interface.

Figure 1-7 Connector panel external appearance

Power Supply Connector

This connector is used to connect the printer to an external power source.

Printer Side: Hosiden TCS7960-532010 or equivalent

User side: Hosiden TCP8927-631100 or equivalent
Hosiden TCP8927-531100 or equivalent

Pin number	Signal name
1	+24 VDC
2	GND
3	NC
Shell	Frame GND

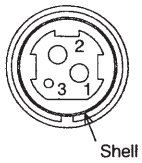


Figure 1-8 Power supply connector

Note:
Be sure to connect the ground wire to the printer using the FG screw on the bottom of the printer.

Drawer Kick-out Connector (Modular Connector)

The pulse specified by **ESC p** is output to this connector. For the serial interface model, the host can confirm the status of the input signal by using the **DLE EOT**, **GS r**, or **GS a** (ASB) commands.

Connector model:

Printer side: MOLEX 52065-6615 or equivalent

User side: 6-position 6-contact (RJ12 telephone jack)

Drawer kick-out connector pin assignments

Pin Number	Signal Name	Direction
1	Frame GND	—
2	Drawer Kick-out drive signal 1	Output
3	Drawer open/close signal	Input
4	+24 V	—
5	Drawer Kick-out drive signal 2	Output
6	Signal GND	—

+24 V is always output through pin 4 during power on.

⚠ CAUTION

Pin 4 must be used only for the drawer.

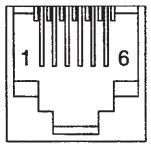


Figure 1-9 Drawer kick-out connector

Drawer kick-out drive signal

Output signal: Output voltage: Approximately 24 V

Output current: 1A or less

⚠ CAUTION:

To avoid an overcurrent, the resistance of the drawer kick-out solenoid must be 24 Ω or more.

Output waveform: Outputs the waveforms in Figure 1-9 to the points A and B in Figure 1-10.

t1 (ON time) and t2 (OFF time) are specified by ESC p.

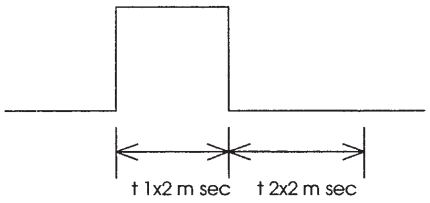


Figure 1-10 Drawer kick-out drive signal output waveform

Drawer open/close signal

Input signal level (connector pin 3):	"L" = 0 to 0.8 V
	"H" = 2 to 5 V

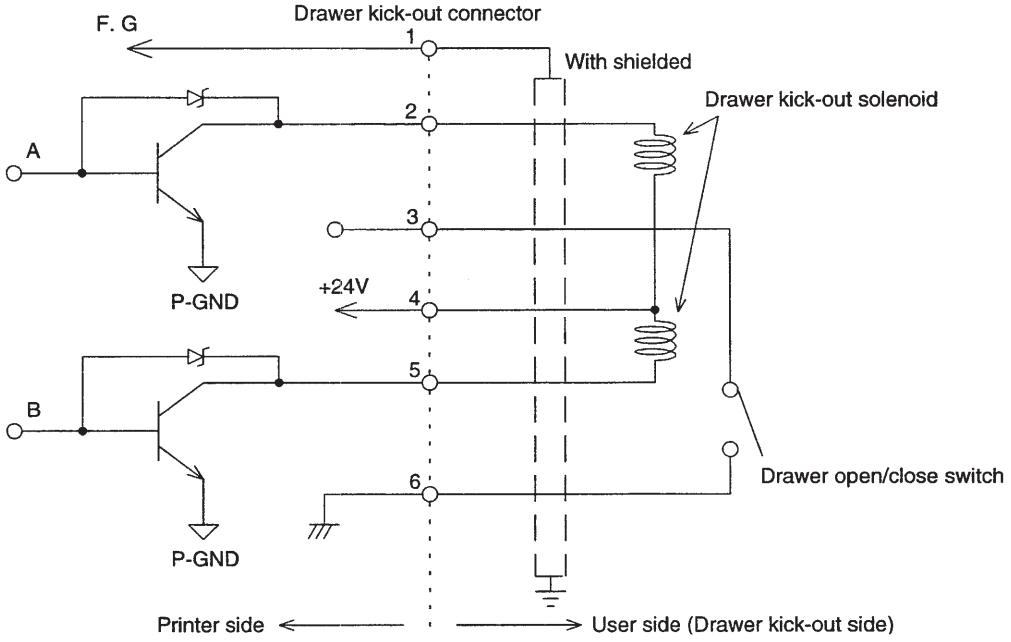


Figure 1-11 Drawer circuitry

⚠ CAUTIONS:

Use a shielded cable for the drawer connector cable.
Two driver transistors cannot be energized simultaneously.
The drawer drive duty must be as shown below.

$$\frac{\text{ON Time}}{(\text{ON time} + \text{OFF time})} \leq 0.2$$

Be sure to use the printer power supply (connector pin 4) for the drawer power source.
The resistance of the drawer kick-out solenoid must not be less than the specified (24 W). Otherwise, an overcurrent could damage the solenoid.
Do not connect a telecommunication network to the drawer kick-out connector.

Interface

Note:
See the appendix for the information about the IEEE 1284 parallel interface and the RS-485 serial interface.

RS-232 serial interface

Specifications

Data transmission:	Serial
Synchronization:	Asynchronous
Handshaking:	DTR/DSR or XON/XOFF control
Signal levels:	MARK = –3 to –15 V: Logic "1"/OFF
	SPACE = +3 to +15 V: Logic "0"/ON
Baud rate:	2400, 4800, 9600, 19200 bps
Data word length:	7 or 8 bits
Parity:	None, even, odd
Stop bits:	1 or more
Connector (printer side):	Female DSUB-25 pin connector

Notes:
The handshaking, data word length, baud rate, and parity depend on the DIP switch settings.
Data transmitted from the printer has 1 stop bit (fixed).

Switching between on-line and off-line

The printer does not have an on-line/off-line switch. The printer goes off-line:

- ❑ Between when the power is turned on (including reset using the interface) and when the printer is ready to receive data
- ❑ During the self-test
- ❑ When the cover is open
- ❑ During paper feeding using the paper feed switch
- ❑ When the printer stops printing due to a paper-end (in cases when an empty paper supply is detected by either paper roll end detector or the paper roll near-end detector with a printing halt feature using **ESC c 4**)
- ❑ During macro executing standby status.
- ❑ When a temporary abnormality ocurrs in the power supply voltage.
- ❑ When an error has occurred

Interface connector terminal assignments and signal functions are described in the table below.

TM-T88 series printer status and signals

Pin number	Signal name	Signal direction	Function
1	FG	—	Frame ground
2	TXD	Output	Transmit data
3	RXD	Input	Receive data
4	RTS	Output	Same as DTR signal (Pin 20)
6	DSR	Input	This signal indicates whether the host computer can receive data.
			SPACE indicates that the host computer can receive data, and MARK indicates that the host computer cannot receive data.
			When DTR/DSR control is selected, the printer transmits data after confirming this signal (except when transmitting data by **DLE EOT,** and **GS a**).
			When XON/XOFF control is selected, the printer does not check this signal.
			Changing the DIP switch setting enables this signal to be used as a reset signal for the printer.
			The printer is reset when the signal remains MARK for 1 ms or more.
7	SG	—	Signal ground

TM-T88 series printer status and signals (continued)

<table>
<tr><th>Pin number</th><th>Signal name</th><th>Signal direction</th><th>Function</th></tr>
<tr><td rowspan="2">20</td><td rowspan="2">DTR</td><td rowspan="2">Output</td><td>1) When DTR/DSR control is selected, this signal indicates whether the printer is busy. SPACE indicates that the printer is ready to receive data, and MARK indicates that the printer is busy. The busy condition can be changed by using DIP SW 2-1 as follows:
<table>
<tr><th colspan="2" rowspan="2">Printer</th><th colspan="2">DIP SW 2-1 status</th></tr>
<tr><th>ON</th><th>OFF</th></tr>
<tr><td rowspan="8">Off-line</td><td>1. During the period from when the power is turned on (including resetting using the interface) to when the printer is ready to receive data.</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td>2. During the self-test.</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td>3. When the cover is open.</td><td>-</td><td>BUSY</td></tr>
<tr><td>4. During paper feeding using the paper feed switch.</td><td>-</td><td>BUSY</td></tr>
<tr><td>5. When the printer stops printing due to a paper-end.</td><td>-</td><td>BUSY</td></tr>
<tr><td>6. During macro executing standby status.</td><td>-</td><td>BUSY</td></tr>
<tr><td>7. When a temporary abnormality ocurrs in the power supply voltage.</td><td>-</td><td>BUSY</td></tr>
<tr><td>8. When an error has occurred.</td><td>-</td><td>BUSY</td></tr>
<tr><td></td><td>9. When the receive buffer becomes full.</td><td>BUSY</td><td>BUSY</td></tr>
</table></td></tr>
<tr><td>2) When XON/XOFF control is selected:

The signal indicates whether the printer is correctly connected and is ready to receive data. SPACE indicates that the printer is ready to receive data. The signal is always SPACE except in the following cases:

• During the period from when the power is turned on to when the printer is ready to receive data
• During the self-test</td></tr>
<tr><td>25</td><td>INIT</td><td>Input</td><td>Changing the DIP switch setting enables this signal to be used as a reset signal for the printer.

The printer is reset when the signal remains SPACE for 1 ms or more.</td></tr>
</table>

Notes:
When the remaining space in the receive buffer drops to 16 bytes, the printer status becomes "buffer full" and it remains "buffer full" until the space in the receive buffer increases to 26 bytes.

The printer ignores the data received when the remaining space in the receive buffer is 0 bytes.

XON/XOFF transmit timing

When XON/XOFF control is selected, the printer transmits XON or XOFF signals as follows. Transmit timing differs depending on the DIP SW2-1 setting.

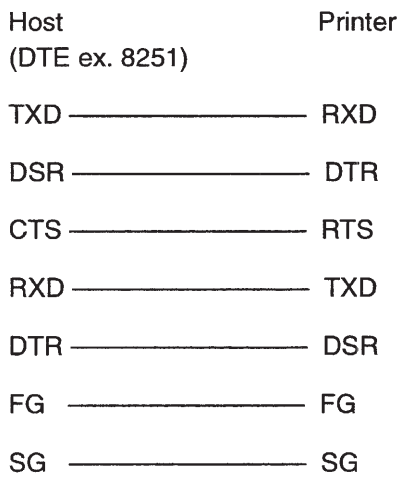
XON/XOFF transmit timing

	Printer status	DIP SW 1-3 status	
		ON	OFF
XON transmission	1) When the printer goes on-line after turning on the power (or reset using interface)	Transmit	Transmit
	2) When the receive buffer is released from the buffer full state	Transmit	Transmit
	3) When the printer switches from off-line to on-line	—	Transmit
	4) When the printer recovers from an error using the **DLE ENQ 1** or **DLE ENQ 2** commands	—	Transmit
XOFF Transmission	5) When the receive buffer becomes full	Transmit	Transmit
	6) When the printer switches from on-line to off-line	—	Transmit

Notes:

- *The XON code is <11>H and the XOFF code is <13>H.*
- *In case 3, XON is not transmitted when the receive buffer is full.*
- *In case 6, XOFF is not transmitted when the receive buffer is full*

Serial interface connection example.



Notes:

Set the handshaking so that the transmit data can be received.

Transmit data to the printer after turning on the power and initializing the printer.

Notes on setting DIP switch 2-1 to ON

- ❑ The printer mechanism stops but does not become busy when: an error has occurred, the cover is open, printing stops due to a paper-end, or paper is fed using the paper feed switch.
- ❑ When setting DIP switch 2-1 to ON to enable handshaking with the printer, be sure to check the printer status using the **GS a** command and the ASB function. In this setting, the default value of n for **GS a** is 2. The printer automatically transmits the printer status, depending on on-line/off-line changes.
- ❑ When using **DLE EOT** and **DLE ENQ**, be sure that the receive buffer does not become full.
  - When using a host that cannot transmit data when the printer is busy:

    If an error has occurred, **DLE EOT** and **DLE ENQ** cannot be used when the printer is busy due to a receive buffer-full state.
  - When using a host that can transmit data when the printer is busy:

    When the receive buffer becomes full while transmitting bit-image data, **DLE EOT** or **DLE ENQ** used while sending the bit-image data is processed as bit-image data. The data transmitted when the receive buffer is full may be lost.

    Example: Check the printer status using **GS r** after transmitting each line of data and use the 4K byte receive buffer. Transmit one line of data so that the receive buffer does not become full.

Notes on Resetting the Printer Using the Interface

The printer can be reset using interface pins 6 and 25 by changing the DIP switch setting.

Reset switching

Signal Line	DIP Switch	Reset Condition
Pin 6 (DSR)	DSW 2-7: ON	MARK level input
Pin 25 (INIT)	DSW 2-8: ON	SPACE or TTL-HIGH level input

To reset the printer, the following requirements must be satisfied.

- ❑ DC characteristics:

Reset DC characteristics

		Pin 6 (DSR)	Pin 25 (INIT)
Reset active voltage	V_A	-15V ~ -3 V	+2 to +15 V
Reset negative voltage	V_N	+3 V ~ +15 V	-15 to + 0.8 V
Reset active current	I_A	-5.3 mA (maximum)	1 mA (maximum)
Reset negative current	I_N	5.0 mA (maximum)	-2 mA (maximum)
Input impedance	R_{IN}	3 KΩ (minimum)	

- AC characteristics:

  Minimum reset pulse width: TRS 1 msec (minimum)

- When using pin 6 (DSR) (DIP switch 2-7 is ON):

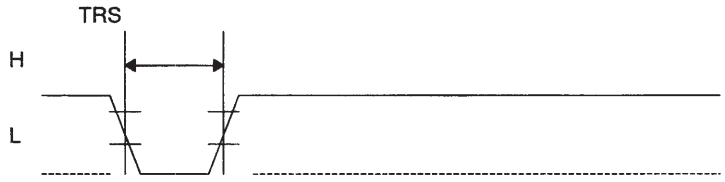


Figure 1-12 Minimum reset pulse width (pin 6)

- When using pin 25 (INIT) (DIP switch 2-8 is ON):

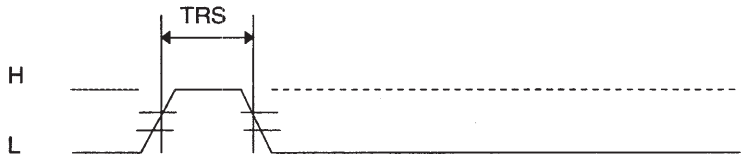


Figure 1-13 Minimum reset pulse width (pin 25)

Notes:

When a signal that does not satisfy the requirements above is input, printer operation is not guaranteed. When a signal is input to pin 25 (INIT) at the TTL level, the requirements above must also be satisfied. Although a signal is input to pin 6 (DSR) at the TTL level, according to the DC characteristics described above, the operation is not guaranteed and pin 6 cannot be controlled.

When pin 6 (DSR) and pin 25 (INIT) are open, the printer is operating.

Buttons and Switches

Power Switch

Type: Rocker switch

Function: The power switch turns the power on or off.

Note:
Turn on the power only after connecting the power supply.

Panel Button

Feed (FEED) **button:** Non-locking push button

[Function] If you push this button once and release it, the printer feeds paper for one line based on the line spacing set by **ESC 2** and **ESC 3**. If you hold down the button, the printer will feed paper continuously.

Paper feeding using the FEED button cannot be performed under the following conditions:

1. The paper roll end sensor detects a paper end
2. When the printer cover is open.

If you push this button when the printer is in the macro execution standby state, the defined macro is executed.

During self-test printing, you can stop the self test temporarily by pressing this button and restart it by pressing the button again.

Note:
*The **ESC c 5** command enables or disables the panel button. When disabled, the button will not function.*

DIP Switches

For the serial interface model

The DIP switches are located at the bottom of the case.

DIP switch 1

DIP Switch	Function	ON	OFF
1	Data reception error	Ignored	Prints "?"
2	Receive buffer capacity	Data buffer 45 bytes	Data buffer 4 KB
3	Handshaking	XON/XOFF	DTR/DSR
4	Data word length	7 bits	8 bits
5	Parity check	Yes	No
6	Parity selection	Even	Odd
7	Transmission speed selection Refer to Transmission Speed Table		
8			

Transmission speed

Transmission Speed (BPS)	SW 1-7	SW 1-8
2400	ON	ON
4800	OFF	ON
9600	ON	OFF
19200	OFF	OFF

BPS: Bits Per Second

DIP switch 2

SW 2	Function	ON	OFF
1	Handshaking (BUSY condition)	Receive buffer full	Off line or receive buffer full
2	Reserved (do not change settings)	Fixed to OFF	
3	Selects print density	Refer to Print Density Selection Table	
4			
5	Reserved (do not change settings)	Fixed to OFF	
6	Reserved (do not change settings)	Fixed to Off	
7	I/F pin 6 reset signal (*1)	Enabled	Disabled
8	I/F pin 25 reset signal (*2)	Enabled	Disabled

(*1)(*2) With the RS-485 serial interface specification (a dealer option), DIP Switches 2-7 and 2-8 are disabled.

Print density selection

Print Density	SW 2-3	SW 2-4
1 (Light)	ON	ON
2	OFF	OFF
3	ON	OFF
4 (Dark)	OFF	ON

Notes:

- *Changes in DIP switch settings (excluding switches 2-7 and 2-8 interface reset signals) are*

For parallel interface model

DIP switch 1

DIP Switch	Function	ON	OFF
1	Auto line feed	Always enabled	Always disabled
2	Receive buffer capacity	Data buffer 45 bytes	Data buffer 4kB
3-8	Not defined	—	—

DIP switch 2

DIP Switch	Function	ON	OFF
1	Handshaking (BUSY condition)	• Receive buffer full • Data reading	• Off-line • Receive buffer full • Data reading
2	Reserved (do not change the setting)		Fixed to OFF
3	Selects print density	Refer to print density selection table	
4			
5-7	Reserved (do not change the setting)		Fixed to OFF
8	I/F pin 31 reset signal (do not change the setting)	Fixed to ON	

Print density selection

Print Density	SW 2-3	SW 2-4
1 (Light)	ON	ON
2	OFF	OFF
3	ON	OFF
4 (Dark)	OFF	ON

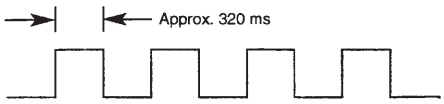
Notes:

- *Changes in DIP switch setting (excluding 2-8, interface reset signal) are recognized only when the printer power is turned on or when the printer is reset by using the interface. If the DIP switch setting is changed after the printer power is turned on, the change does not take effect until the printer is turned on again or is reset.*
- *If you turn on DIP switch 2-8 while the printer power is turned on, the printer may be reset, depending on the signal state. DIP switches should not be changed while the printer power is on.*
- *If the print density is set to level 3 or 4, printing speed is inclined to be low speed.*

Panel LEDs

Power (POWER) **LED:**	Green	
	On:	Power is stable.
	Off:	Power is not stable.
Error (ERROR) **LED:**	Red	
	On:	Off line (except during paper feeding using the FEED button, self-test printing, and the error state)
	Off:	Normal condition.
	Blinking:	Error
Paper roll end (PAPER OUT) LED:	Red	
	On:	The paper roll near end is detected.
	Off:	Paper is loaded (Normal condition)
	Blinking	Self-test standby state (See Chapter 4) or macro standby state

Paper LED blinking pattern

State	PAPER LED Blinking Pattern	Recovery Conditions
Waiting for self-test printing to be continued or macro execution ready state.	PAPER OUT 	Pressing the PAPER FEED button causes self-test printing to be continued or executes the macro.

Note: A macro can be executed r times (r specifies the number of times to execute the macro) within the specified definition range. The macro can be executed continuously or can be executed by pressing the button. If the macro is executed by pressing the FEED button, the PAPER LED blinks to indicate the macro execution ready state.

Figure 1-14 Panel Button and Indicators

Self-test

The printer has a self-test function that checks the following:

- ❑ Control circuit functions
- ❑ Printer mechanisms
- ❑ Print quality
- ❑ Control Software version
- ❑ DIP switch settings.

See Chapter 4 for instructions on running a self-test.

Hexadecimal Dump

Hexadecimal Dumping Function

This function prints the data transmitted from the host computer in hexadecimal numbers and in their corresponding characters.

Performing a Hexadecimal Dump

Open the cover and turn the power on while pressing the FEED button; then close the cover. The printer first prints "Hexadecimal Dump" on paper roll and prints the received print data in hexadecimal numbers and in its corresponding characters.

Notes:
If no characters correspond to the data received, the printer prints ".".

Control commands are printed in bold for emphasis.

During hexadecimal dumping, any commands other than ***DLE EOT*** *and* ***DLE ENQ*** *do not function.*

Insufficient print data to fill the last line can be printed by setting the printer off-line.

Ending hexadecimal dumping

Hexadecimal dumping ends by turning the power off or resetting the printer via the interface after printing has finished.

<Printing example>

1B 21 **00** **1B** 26 **02** 40 40 .!..&.@ @

1B 25 **01** **1B** 63 34 **00** **1B** .%. .c4. .

41 42 43 44 45 46 47 48 ABCDEFGH

Paper Sensors

The printer has 2 paper sensors as follows:

- Paper roll near-end sensor

  The sensor which detects a near-end of a paper roll.
  When the paper roll diameter becomes sufficiently small, the sensor detects a near-end of the paper roll and the PAPER LED indicator lights. If the sensor is enabled by **ESC c 4**, the printer stops printing.

- Paper roll end sensor

  This sensor detects whether paper is present or not.
  When the sensor detects a paper-end, the printer stops printing.

Note:
After installing new paper roll, close the printer cover; then the printer restarts printing.

Cover Open Button

When the cover open button (located to the right of the cover) is pressed, the printer cover is opened. When the cover is closed, the cover open button is latched.

Notes:
Be sure to use the cover open button to open the printer cover.
Do not open the cover during printing.
Do not open the cover during the auto-cutting operation; otherwise the mechanism may be damaged.

Cover Open Sensor

The cover open sensor monitors the printer cover. When the sensor detects a cover open during printing, the error LED blinks and the printer stops printing. The printer recovers when the cover is closed. When the sensor detects a cover open while the printer is in the standby status, the printer goes off-line. The printer recovers when the cover is closed.

Note:
Whether the cover is open or not does not affect the status reported by the paper roll end sensor.

Print Buffer-full Printing

When subsequent data is received after the printer processes one line of data in the print buffer, the printer automatically prints the processed line and feeds the paper by one line (in standard mode).

Standard Accessories

- ❑ Paper roll (diameter 50 mm [1.96"]) × 1 roll
- ❑ Operator's Manual
- ❑ I/F fixing screw (hexagonal millimeter screw) (for serial interface model only)

Options

- ❑ External power supply: PS-170
- ❑ Affixing tapes (model: DF-10)
- ❑ Wall hanging bracket (model: WH-10)
- ❑ RS-485 interface board is equipped as a dealer option

Note:
Use only the PS-170 power supply to avoid damage to the printer and the power supply.

Consumables

Specified thermal roll paper: NTP080-80

In Japan: Nakagawa Seisakujo

In U.S.A.: Nakagawa Mfg. (USA) Inc.

In Europe: Nakagawa Mfg. (Europe) GmbH

In Southeast Asia: N.A.K. Mfg. (Malaysia) SDN BHD

[Original paper: TF50KS-E Nippon Paper Industries Co., Ltd.]

The following paper can be used instead of the specified paper above:

Original paper: PD160R New Oji Paper Mfg. Co., Ltd.

AF50KS-E Jujo Thermal Oy (Finland)

F380 Kanzaki Specialty Papers, Inc. (U.S.A.)

Note:
Do not use any paper other than these specified above. Otherwise, print head reliability and print quality are affected adversely.

External Power Supply PS-170 Specifications

Input specifications

Rated input voltage	90 to 264 V AC
Rated frequency	50/60 Hz ± 3 Hz
Rated input current	less than 100 V A
Power switch	None
Power LED	None

Output specifications

Output voltage	24 VDC ± 5%
Rated output current	2.0 A
Rated output power	Approximately 48 W
Output peak current	4.5 A (within 300ms duty 1/6)

Chapter 2
Mechanisms and Operation

Component Connection Diagram

This printer is made up of the following major components:

- M-T88 Printer Mechanism (Switch circuit board assembly-B)
- I/F circuit board assembly
- Main circuit board unit-A

The block diagram for this printer is shown below.

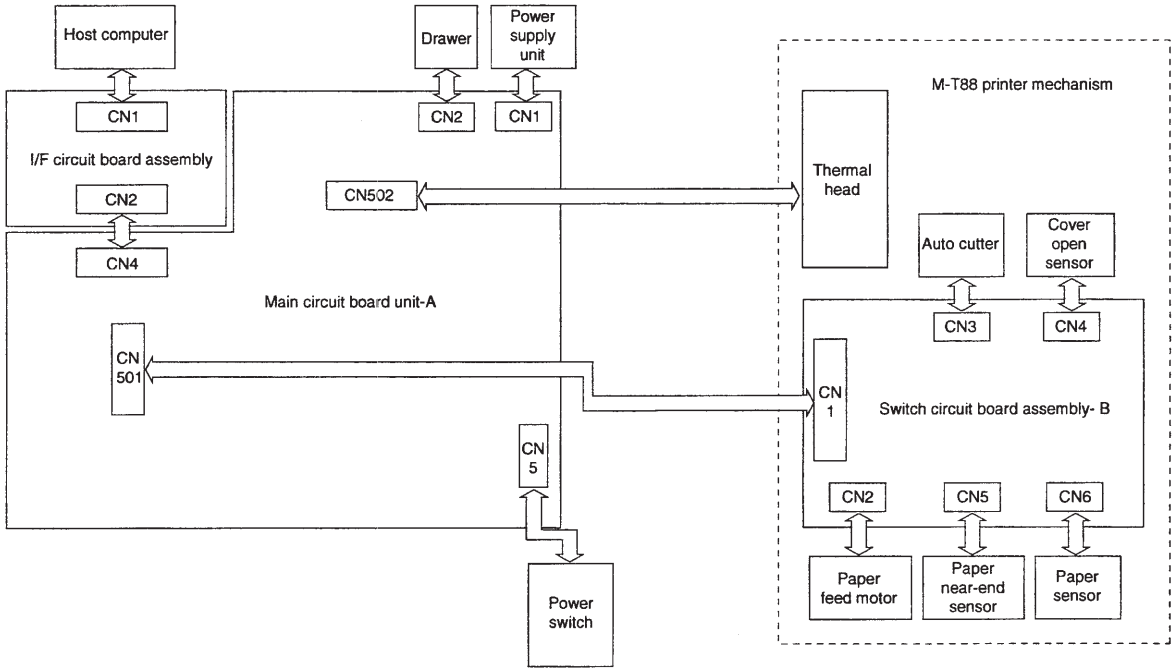


Figure 2.1.1 Component connection diagram

Circuit Block Diagram

The control circuitry of this printer is made up of the following major components:

- ❑ Main circuit board unit-A
- ❑ Switch circuit board assembly-B
- ❑ I/F circuit board assembly

  UB-S01: RS-232 Serial Universal Board
  UB-P01: IEEE 1284 Parallel Universal Board
  UB-S02: RS-485 Serial Universal Board

The component connection diagram for the electrical circuitry components is shown below.

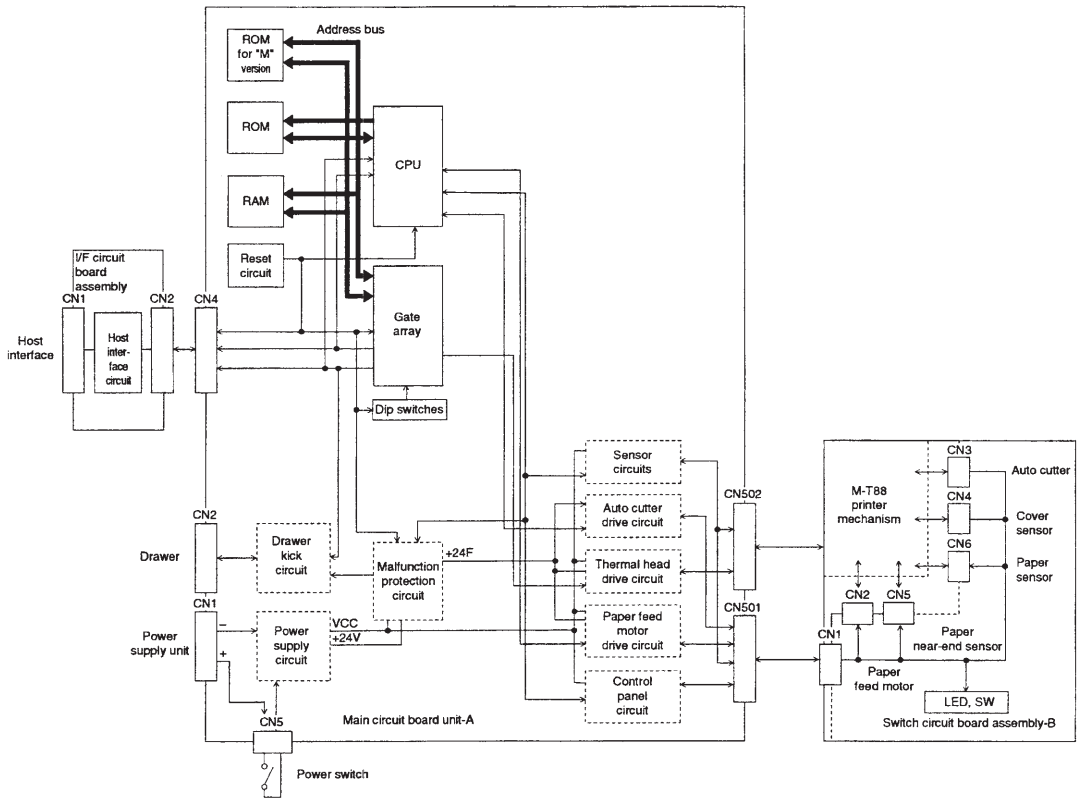


Figure 2.2.1 Electrical circuitry component connection diagram

Memory Map

The following components are mapped in the memory map of this printer:

- CPU
- FLASH ROM (program U6, multi-lingual UN10)
- PS-RAM (pseudo static RAM)

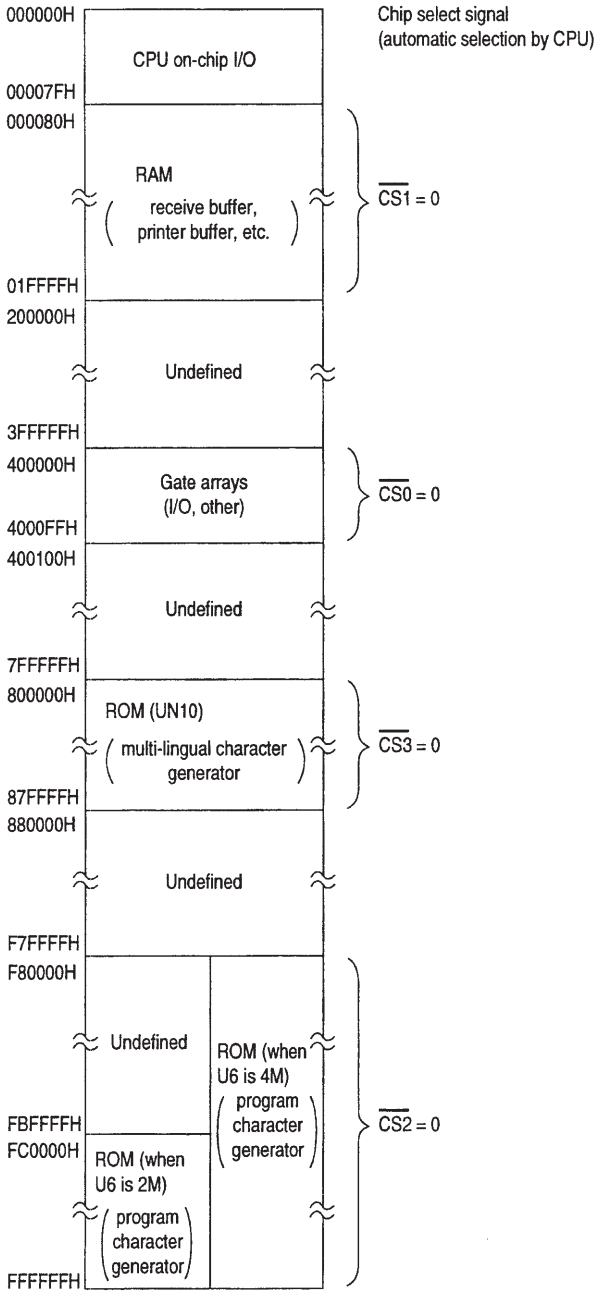


Figure 2.3.1 Memory map

M-T88 Printer Mechanism

This printer consists of six mechanisms: a paper feed mechanism, a paper supply mechanism, a printer mechanism, a cutter mechanism, a cover mechanism, and a display mechanism. The following illustration shows the external configuration of the M-T88.

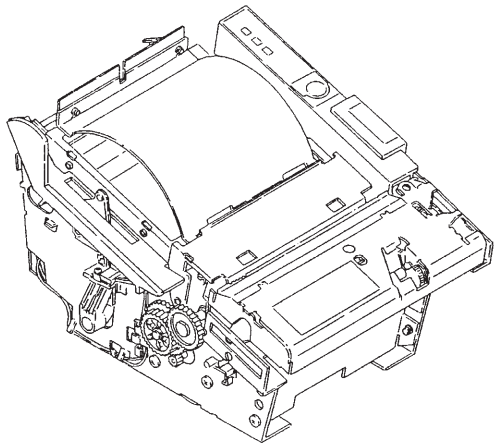


Figure 2.4.1 M-T88 external configuration

Paper Feed Mechanism

Paper feed is performed by a power transfer mechanism that rotates the platen, and a head holding mechanism that presses the thermal head against the platen.

Power transfer mechanism

On the frame cover, the platen is supported by the platen shaft holder so it turns freely. Closing the frame cover causes the platen gear affixed to the platen shaft to mesh with the deceleration gear equipped on the main frame. The rotary force (in the direction of arrow (1)) of the receipt paper feed motor affixed to the main frame is transferred in sequence to the motor gear (press fit to the motor shaft), the deceleration gear, and the platen gear, which rotates the platen in the direction of arrow (2).

A PM type stepping motor is used for the receipt paper motor.

A separate type gear train is used for this mechanism. When the motor rotates in reverse, the pressure angle relationship causes power to work in the direction that the gear train is separated, so reverse motor operation is impossible.

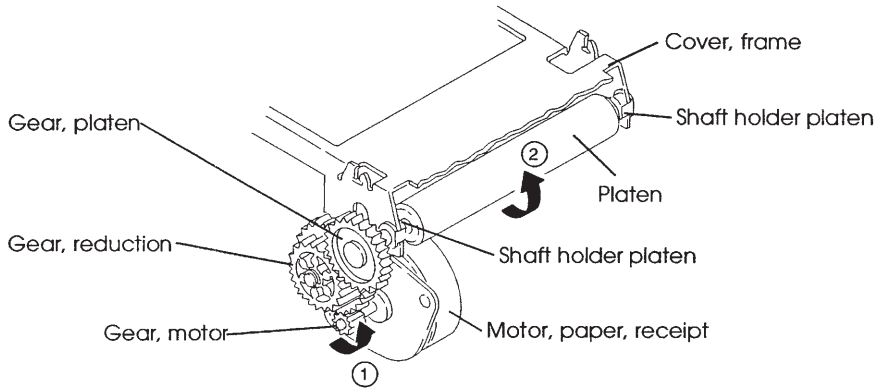


Figure 2.4.2 Power transfer mechanism

Head holding mechanism

Spring pins, which act as bearings, are press fit onto either side of the thermal head. The thermal head bearings are inserted into slots equipped in the main frame. The head holding plate affixed to the main frame has two head holding springs that apply pressure to the back of the thermal head. While the frame cover is open, the thermal head is in contact with the stopper equipped on the main frame.

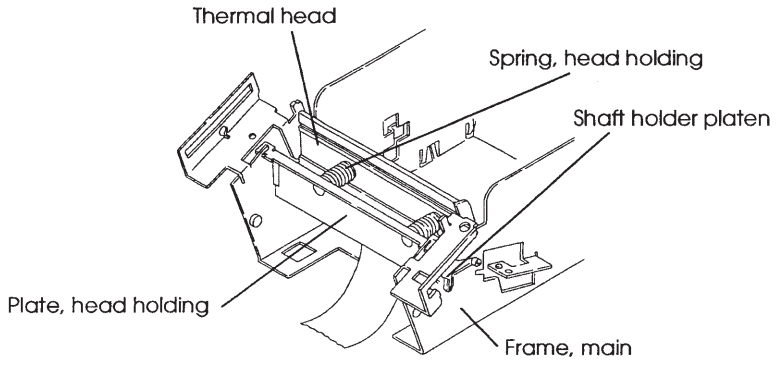


Figure 2.4.3 Head holding mechanism

Closing the frame cover causes the top of the heat shield to come into contact with the platen as shown in Figure 2.4.4. The thermal head separates from the stopper in the direction of arrow (3), and the thermal head tip comes into contact with the platen.

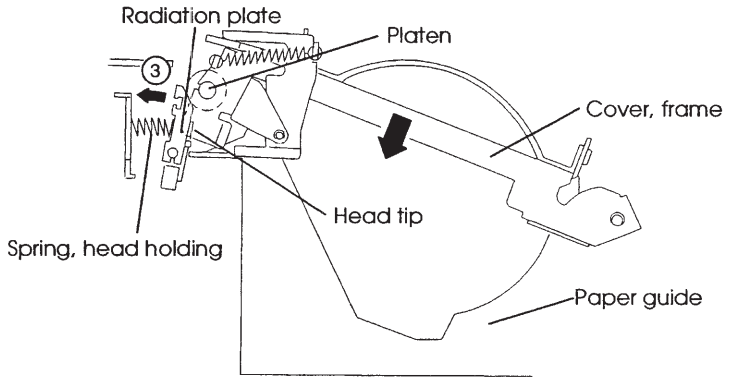


Figure 2.4.4 Platen and thermal head contact

The pressure being applied to the platen by the thermal head acts as downward force on the frame cover, and the platen is fixed in the positioning slot in the main frame. At this time, the slots that support the thermal head bearings open in the direction of the back of the head, so the thermal head can move along the platen applying constant pressure along the print line.

Paper feed operation

Opening the frame cover, installing roll paper, and re-closing the frame cover causes the roll paper to be sandwiched between the thermal head and platen. When the platen is rotated by the power of the motor, friction generated between the platen and the paper feeds the roll paper in the direction of arrow (3). This printer uses one of three print feed speeds, depending on the print pattern. 2-2 phase drive for high-speed printing, and 1-2 phase drive for medium- and slow-speed printing maintains torque while suppressing motor heat generation.

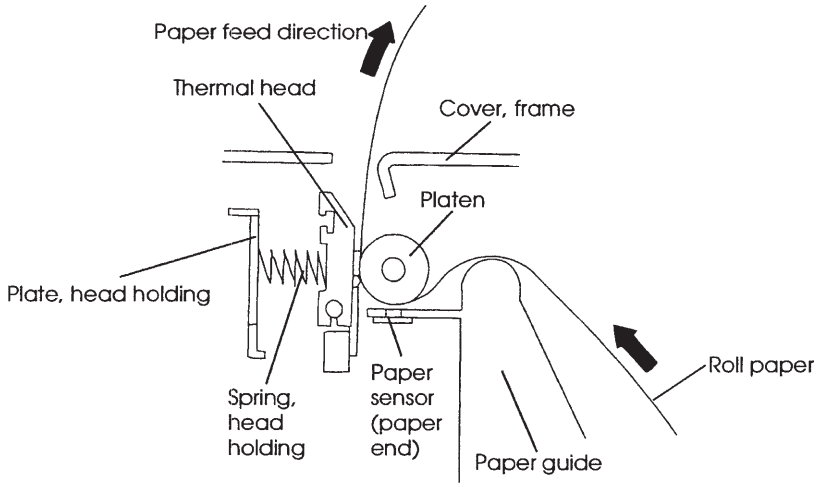


Figure 2.4.5 Paper feed mechanism

Head open mechanism

The printer uses a drop-in paper roll system, and the thermal head is exposed whenever the frame cover is open (head open mechanism). In addition to simplifying paper loading, this design also makes paper jam clearing and platen cleaning quicker and easier.

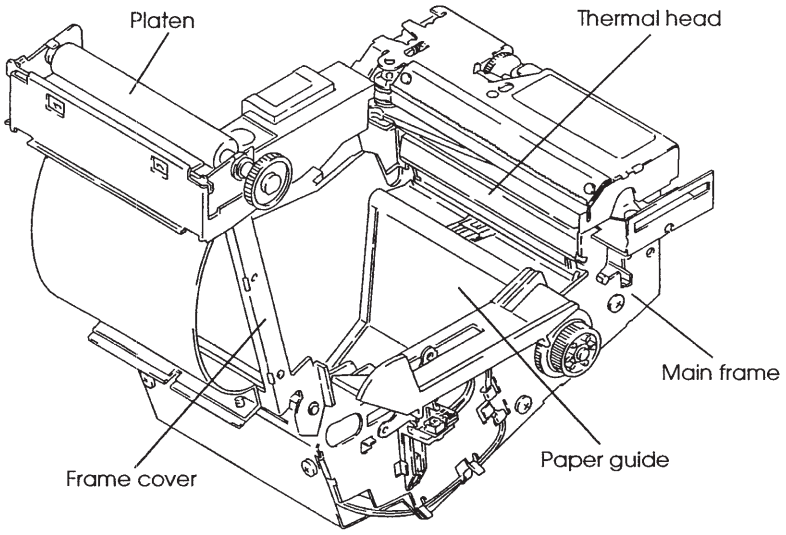


Figure 2.4.6 Frame cover open

The paper outlet of the printer is covered, and even if paper output becomes blocked for some reason, there is enough room in the space between the platen and frame cover for accumulation of two or three normal length receipts (the length of one sheet is assumed to be 80mm or less). This reduces the chance of receipt paper becoming bent and of the print pitch becoming uneven. Paper that accumulates can be easily pulled out of the printer after the paper outlet is opened.

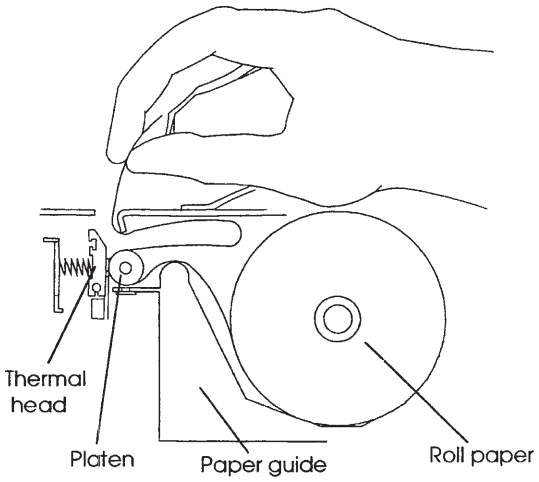


Figure 2.4.7 Roll paper behavior during paper output blockage

Paper Supply Mechanism

The roll paper guide, which holds the paper roll, is affixed to the main frame. The side walls of the paper guide are shaped so they continue up to the thermal head to limit lateral movement of the paper as it is being fed. The paper guide is also equipped with a near end sensor mechanism that detects when the amount of remaining roll paper drops below a prescribed level, and a paper end sensor mechanism that detects the end of the roll paper.

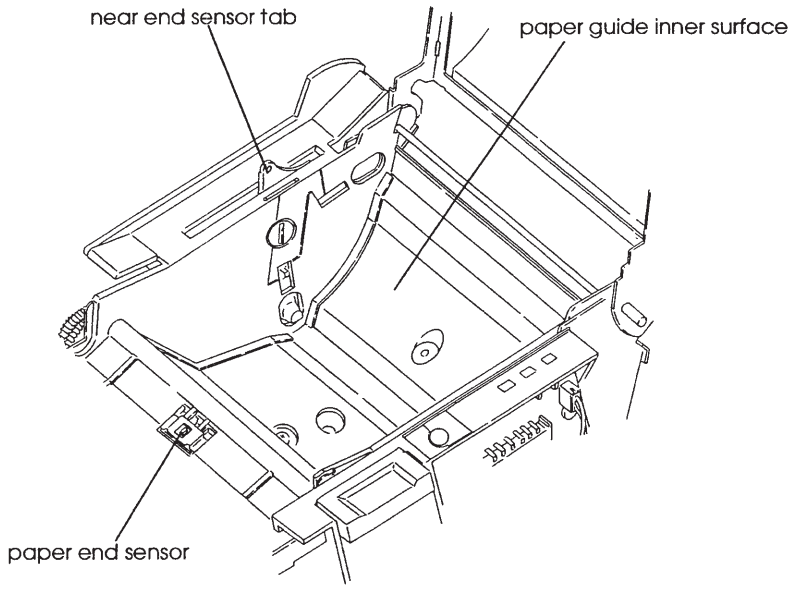


Figure 2.4.8 Paper guide

Near end sensor mechanism

The near end (N.E.) sensor lever is supported by the N.E. sensor holder so it can move. The spring force of the microswitch fixed by a screw to the N.E. sensor holder presses the N.E. sensor lever in the direction of arrow (1) in Figure 2.4.9. The microswitch is linked to the switch circuit board assembly-B by the N.E. sensor lead wire. The N.E. sensor holder is attached to the paper guide by the sensor adjustment screw.

When the paper roll is larger than the prescribed roll paper diameter, the pressure of the outer surface of the paper roll on the N.E. sensor lever causes the lever to press the microswitch, maintaining it in an ON state.

When the remaining paper on the roll is below the prescribed diameter, contact between the tip of the N.E. sensor lever and the paper roll surface is broken, causing the lever to move in the direction of arrow (1), into the core of the paper roll. This causes the microswitch to turn off, indicating near end of the roll paper.

The prescribed near end roll paper amount can be changed between two different levels: one with the N.E. sensor tab fixed in a raised position, and one with the N.E. sensor tab fixed in a lowered position.

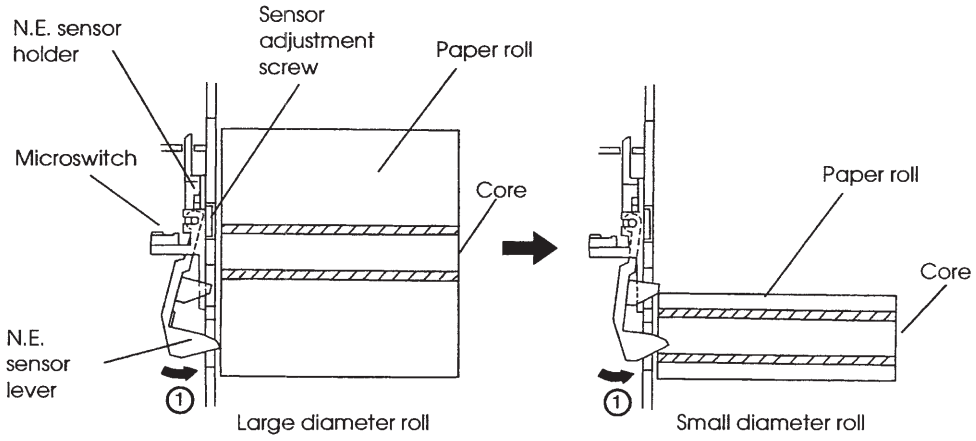


Figure 2.4.9 Near end sensor mechanism

Paper end sensor mechanism

A reflective type photosensor, which consists of an LED and phototransistor, is mounted on the paper sensor board and located in the paper guide paper path. When the end of the roll paper passes the sensor, the volume of light from the LED that makes it to the phototransistor changes. Because the reflectance ratios of the paper and the rubber platen surface are different, a change in the output level of the phototransistor is detected as the end of the paper.

The shield plate provided around the sensor is grounded to the main frame. This printer is designed so that the sensors are exposed when the frame cover is open, but the shield plate acts as a lightning rod to protect sensors against electrostatic damage. The paper sensor board is linked to the switch circuit board assembly-B by the paper sensor lead.

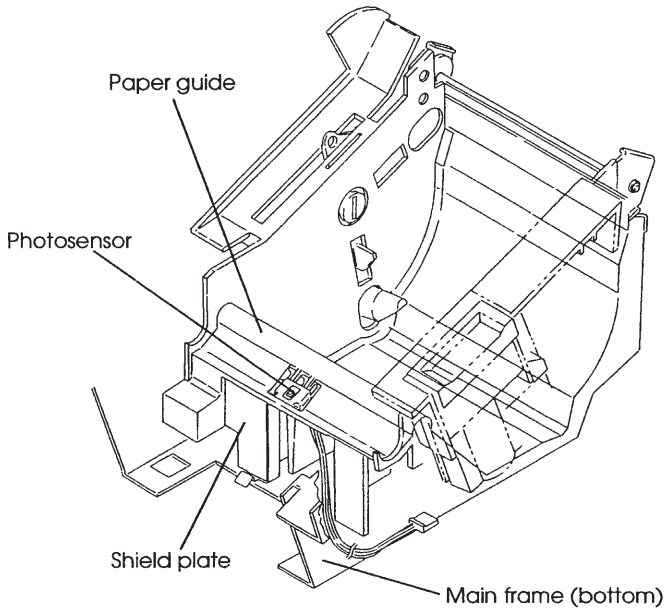


Figure 2.4.10 Paper end sensor mechanism

Printer Mechanism

The thermal head is designed so its heating element is positioned where it comes into contact with the platen. The roll paper wrapped around the platen is kept in contact with the thermal head's heating element at a prescribed pressure, and printing is performed when heat is generated by the heating element.

This printer employs a thick-film thermal head that consists of a head tip with a heating element, a driver IC for driver control of the heating element, a thermistor that monitors the temperature of the thermal head, a heat shield that protects the head tip against abnormal heat, a print circuit board that is linked to the signal line, and head support shafts (spring pins).

The thermal head is connected to the main circuit board unit-A by an FFC connected to the connector. Figure 2.4.12 shows a cross section of the thermal head heating unit and the (thermal) roll paper.

Printing is performed according to the following steps:

1. The print signal sends a prescribed energizing pulse to the electrodes that correspond to each dot to be printed.

2. Resistors at each electrode generate heat.

3. The heat energy generated by the resistors is transmitted to the roll paper surface through the protective layer to the paper's heat sensitive layer, causing coloration of the paper.

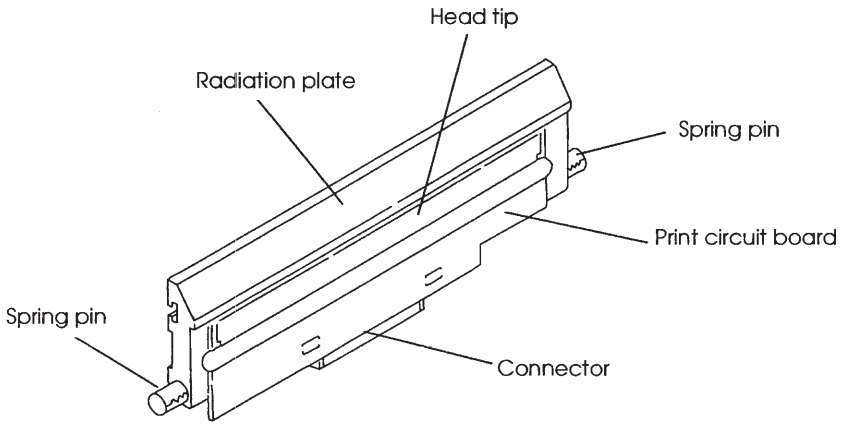


Figure 2.4.11 Thermal head configuration

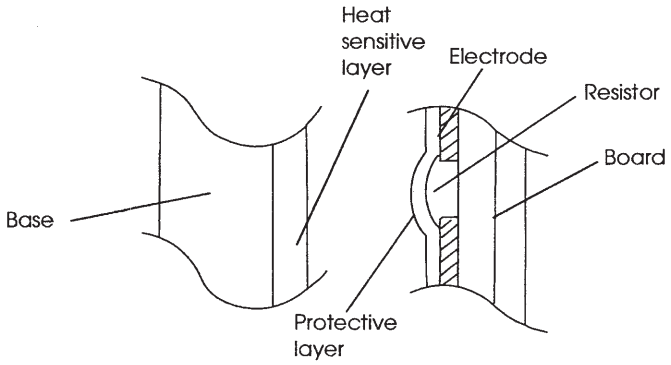


Figure 2.4.12 Thermal paper and thermal head

Data input and printing

Serial print data input from DATA IN is synchronized with the clock, transferred to the shift register, and the print data is stored in the latch in accordance with the latch signal. The stored print data turns on the gate in accordance with the STROBE signal, which energizes the heating element.

There are two strobe pins, STROBE 1 and STROBE 2, and the drive operation is divided between them.

The width of the energizing pulse is set to the optimum value in accordance with the paper feed speed, the temperature picked up by the thermistor, the head supply voltage, whether or not a dot was printed at the previous position, and the print pattern.

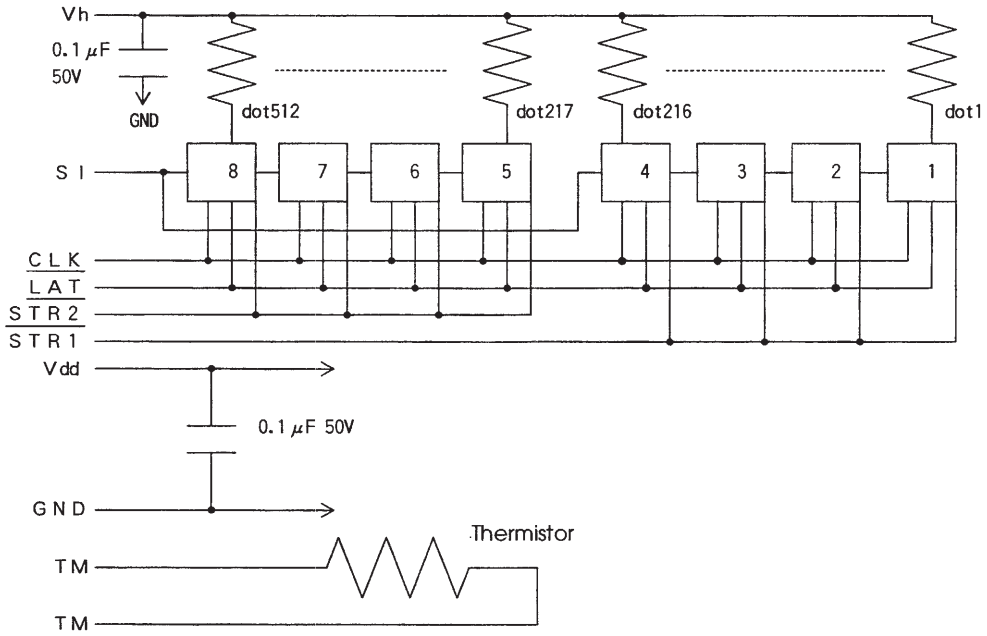


Figure 2.4.13 Thermal head block diagram

Cutter Mechanism

This printer is equipped with an auto cutter mechanism for cutting of the roll paper, and an emergency cutter for manual cutting.

Auto cutter mechanism

The auto cutter has two opposing cutter blades that operate like a scissors to cut the paper. It is a separate cutter blade type mechanism that does not require passage of the roll paper through an auto cutter mechanism slit. Opening the frame cover causes the stationary blade to separate completely from the moving blade. The stationary blade is fixed to the frame cover, while the moving blade is attached to the main frame.

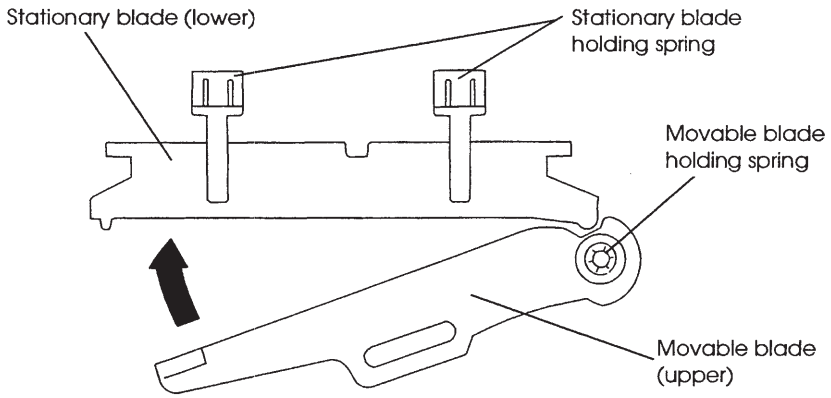


Figure 2.4.14 Scissors type cutter mechanism

Stationary blade mechanism

The stationary blade is attached to the frame cover, and the stationary blade holding spring presses the stationary blade against the frame cover. A blade shutter is installed on the frame cover, where it is pulled by the shutter spring. The blade shutter is a safety mechanism that keeps the stationary blade covered whenever the frame cover is open.

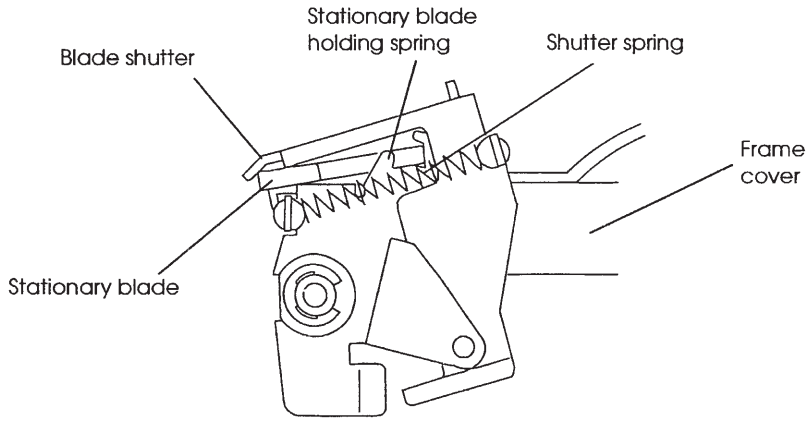


Figure 2.4.15 Stationary blade mechanism

Movable blade mechanism

A paper cutter motor is fixed inside the paper cutter cover, and the cutter motor gear is press fit onto the motor shaft. The paper cutter motor is a DC brush motor. The drive gear is supported by the gear drive shaft (caulked to the paper cutter cover) so it can rotate. The drive gear is retained on the paper cutter cover by a push nut. The rotary force of the paper cutter motor is reduced by the paper cutter motor gear and the drive gear, and then rotates a drive pin that is press fit to the drive gear.

A microswitch is fixed to the paper cutter cover in order to sense the position of the stationary blade. A cam is molded onto the driver gear, and engagement with this cam repeatedly turns the microswitch on and off. The paper cutter motor and microswitch are connected to the switch circuit board assembly-B by the paper cutter lead.

The movable blade support, spacer, movable blade, movable blade holding spring, and movable blade spring washer are equipped on the movable blade shaft, which is caulked to the paper cutter frame. The drive pin fits into an oblong hole in the movable blade, and rotation of the drive pin causes the movable blade to rotate left and right on the movable blade shaft. The microswitch is off (open) when the movable blade is in the wait state.

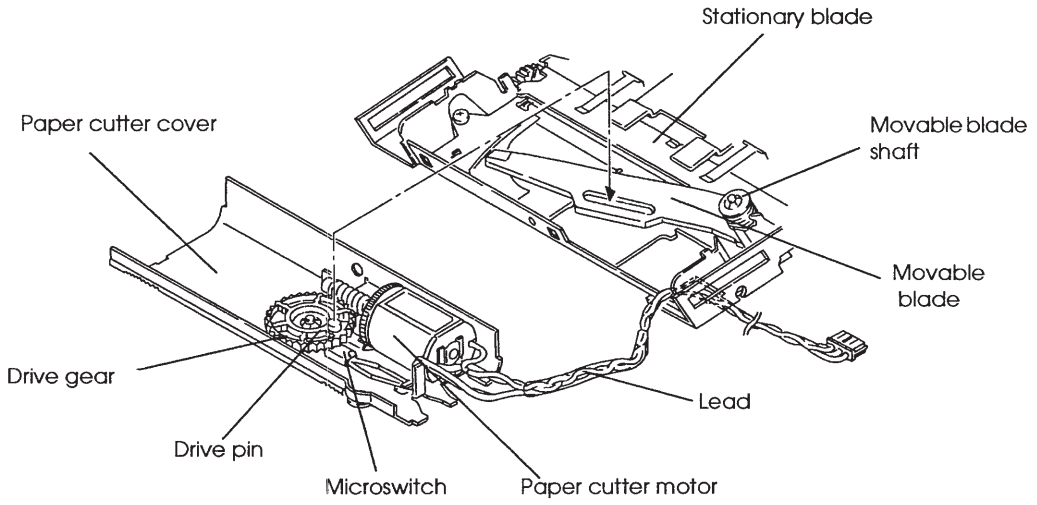


Figure 2.4.16 Movable blade mechanism

Auto cutter operation

The frame cover can be closed while the movable blade is in the home position. Closing the frame cover causes a shaft in the main frame to push up the blade shutter, exposing the stationary blade. Also, the stationary blade is brought into partial contact with the paper cutter frame, and the stationary blade and movable blade are put into opposition. This is the auto cutter enabled state.

The following is a step-by-step description of an auto cut operation:

1. Application of voltage between paper cutter motor terminals causes the motor to rotate clockwise.
2. The drive pin moves the movable blade towards the stationary blade.
3. The movable blade and stationary blade intersect to cut the paper from right to left.
4. An uncut portion is retained on the left and the movable blade returns.
5. The microswitch detects when the movable blade returns to the home position, motor operation is stopped, and movable blade operation is stopped.

Cutter blade knob

The movable blade is in the home position whenever cutter operation is not being performed. In addition to safety considerations, this enables a mechanism in which the frame cover cannot be opened or closed while the movable blade is not in the home position.

When the stationary blade is not in the home position during normal use, the paper cutter motor rotates in reverse to move the stationary blade to the home position. The cutter motor gear has a knob that makes it possible to move the movable blade when the drive force of the motor is unable to return the stationary blade to the home position.

A window is provided in the paper cutter cover in order to make it possible to check whether the movable blade has returned to the home position.

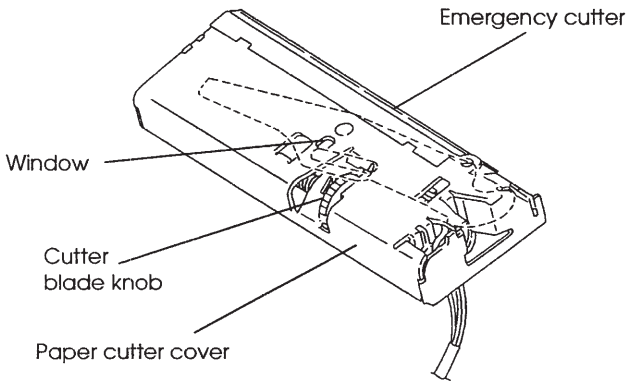


Figure 2.4.17 Cutter blade knob external view

Emergency cutter

The emergency cutter can be used to cut paper manually whenever the auto cutter mechanism does not operate properly because of some problem. The emergency cutter is affixed to the paper cutter cover by screws.

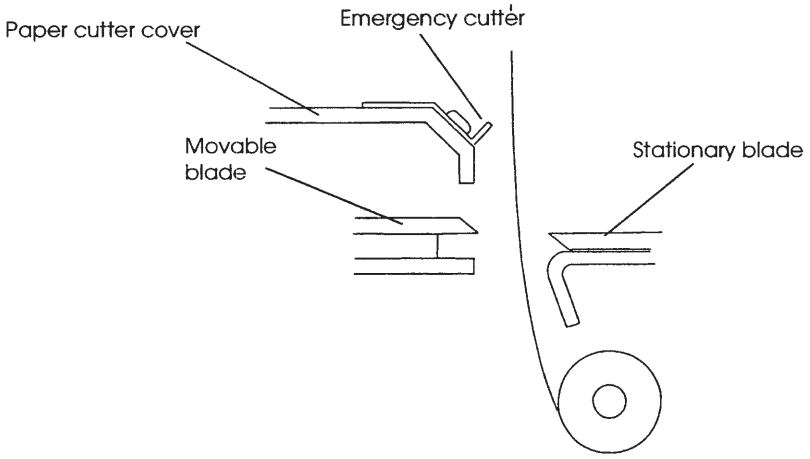


Figure 2.4.18 Emergency cutter cross section

Cover Mechanism

A roll paper cover is fixed to the frame cover. The roll paper cover ensures the strength of the cover section. The frame cover passes through the cover shaft, allowing the roll paper cover to hinge on the main frame. A cover spring affixed to the main frame comes into contact with the shaft on the frame cover, providing optimum load when the frame cover is opened and closed.

switch circuit board assembly-BSince the printer mechanism, including the auto cutter, will not operate properly if the frame cover is not closed correctly, a cover open sensor mechanism is equipped to detect when the frame cover is not closed correctly. A cover open button mechanism is also provided to partially open the cover.

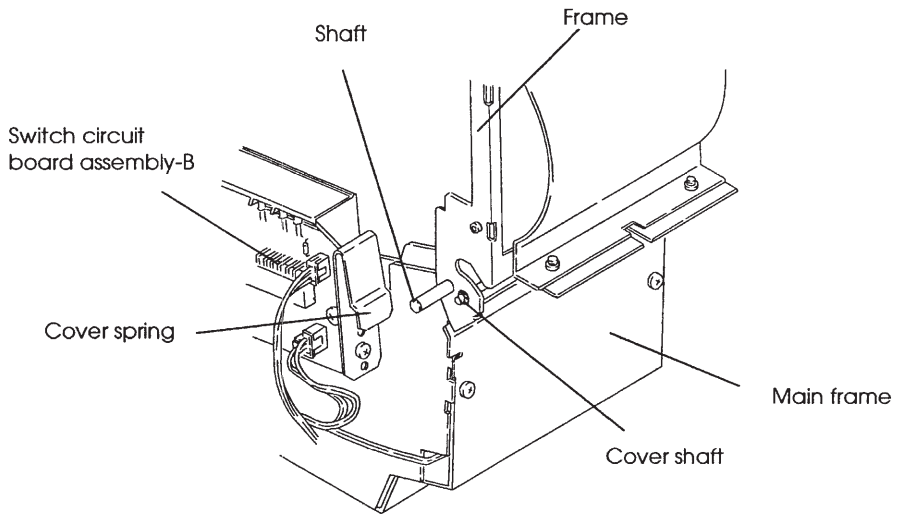


Figure 2.4.19 Cover spring external configuration

Cover open sensor mechanism

A transmissive type photosensor, consisting of an LED and phototransistor, is mounted on the cover open board, and affixed to the main frame. The frame cover is shaped so it fits into the photosensor, and closing of the frame cover causes the cover to enter into the photosensor slit, cutting the optic axis. When the frame cover is raised, on the other hand, photosensor light passes through the slit. This makes it possible to detect whether or not the cover is open by monitoring the output level of the photo transistor.

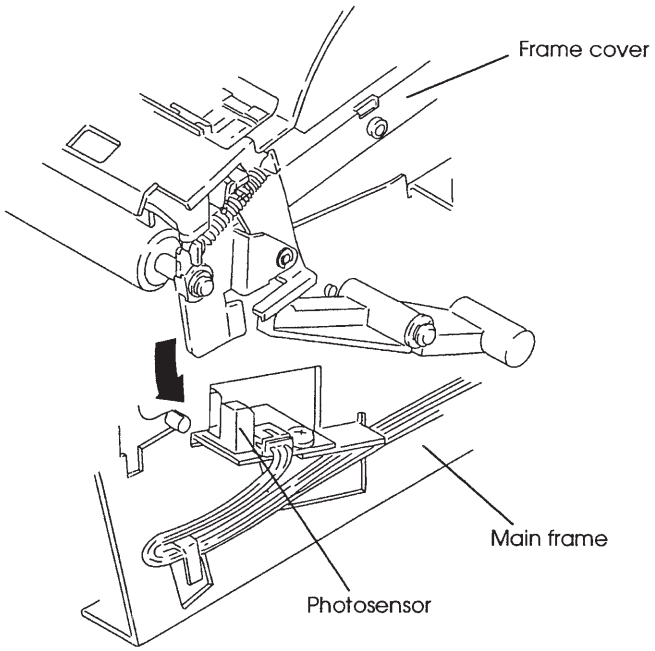


Figure 2.4.20 Cover open sensor mechanism

Cover open button mechanism

The cover open lever is supported by the main frame shaft. The cover open button along with its return spring is supported by the side of the paper guide. Pressing the cover open button while the frame cover is closed causes part of the cover open button to link with the cover open lever, which rotates the cover open lever. The cover open lever pushes up the shutter blade, which pushes up the frame cover. The platen pushes up the thermal head, separating them. This removes the force stopping the frame cover, making it possible to open the frame cover with little power. When the operator releases the cover open button, the cover open button is returned to its prescribed position by the return spring.

The cover can also be opened by directly pulling up on the thermal cover AA (plastic cover) with strong force.

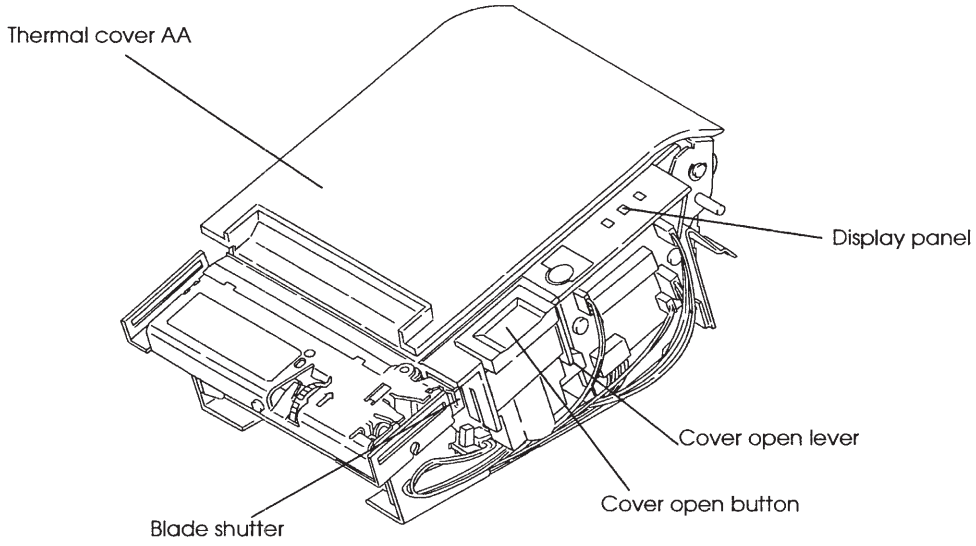


Figure 2.4.21 Cover open button mechanism

Display Mechanism

The display panel, which is located inside the paper guide, has three LEDs (POWER, ERROR, PAPER OUT) and one push-button (FEED).

In order to simplify maintenance, signal lines such as motors and sensors (except for the thermal head signals) are all connected to the switch circuit board assembly-B by the leads and connectors, and switch circuit board assembly-B is connected by FFC to the main circuit board unit-A. The switch circuit board assembly-B is affixed to the arm coming out of the main frame. The control panel LEDs and push-button are mounted on switch circuit board assembly-B.

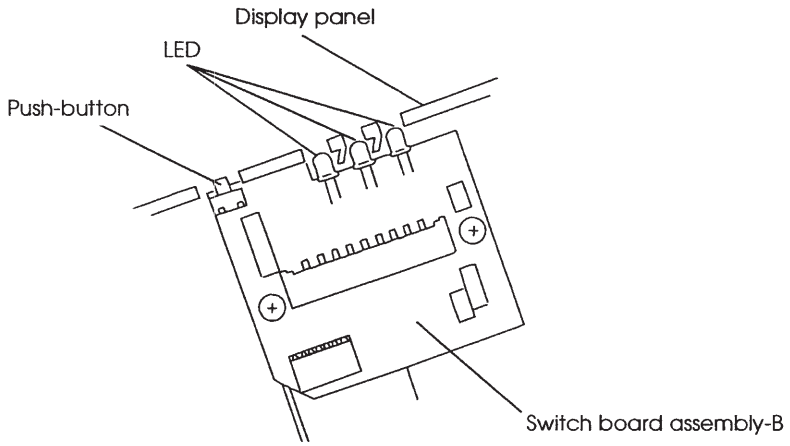


Figure 2.4.22 Switch circuit board assembly-B external configuration

Main Circuit Board Unit-A

The main circuit board unit-A is made up of the following electrical circuits:

- ❑ CPU and CPU Peripheral Logic Circuits

  CPU
  RAM
  ROM
  Gate array
  Reset circuit

- ❑ M-T88 Control Circuits

  Thermal head drive circuit
  Paper feed motor drive circuit
  Auto cutter drive circuit
  Detector circuits

- ❑ Operation Panel Control Circuits

- ❑ DIP Switch Read Circuit

- ❑ Malfunction Protection Circuit

- ❑ Drawer Kick Control Circuit

- Power Supply Circuits

  Filter circuit
  +24V output circuit
  +5V output circuit

CPU and CPU Peripheral Logic Circuits

CPU

The CPU (U4) of this printer has an 8-bit external data bus, a 16-bit internal data bus, and a 19.66MHz external clock. The CPU (U4) controls the printer in accordance with the printer control program written in flash ROM (U6). The following table shows the function of each CPU pin.

CPU signal assignments and functions

No.	Pin name	Signal name	Function	I/O	Level
1	P65		Not used. Open	O	TTL
2	P70		Not used. Open	O	TTL
3	P71		Not used. Open	O	TTL
4	P72		Not used. Open	O	TTL
5	P73		Not used. Open	O	TTL
6	P74	RPF_+A	Receipt side	O	TTL
7	P75	RPF_+B	Paper feed motor drive control: 2-2 phase drive	O	TTL
8	P76	RPF_-A	OR 1-2 phase drive	O	TTL
9	P77	RPF_-B	All terminals ON (L): hold	O	TTL
10	$\overline{\text{NMI}}$	NMI	Not used. +5V direct connection	I	TTL
11	P80/TXD0	TXD	HOST I/F SD L:ON	O	TTL
12	P81/RXDO	RXD	HOST I/F RD L:ON	I	TTL
13	P82/ SCLKO	CLK IN/DTR	HOST I/F CLK IN/DTR	O	TTL
14	P83	CLK REQ	HOST I/F CLK REQ	O/I	TTL
15	P84	CTS	HOST I/F CTS L:ON	O	TTL
16	P85	DET	HOST I/F DET	I	TTL
17	AGND	AGND	(A/D converter) GND terminal	I	(0V)
18	VREF	VREF	A/D converter reference voltage	I	(+5V)
19	VCC	VCC	Main power supply terminal (+5V)	I	(+5V)
20	P90/AN0	AN0OUT	V DTC: +24V power supply voltage value detection	I	Analog
21	P90/AN1	AN1OUT	RRE: Receipt paper detect signal	I	Analog
22	P90/AN2	AN2OUT	THR: receipt head temperature detect signal (thermal head)	I	Analog
23	P90/AN3		Not used. Open	I	Analog
24	AM8/$\overline{16}$	AM8/$\overline{16}$	+5V direct connection	I	TTL

CPU signal assignments and functions (continued)

No.	Pin name	Signal name	Function	I/O	Level
25	CLK	CLK	Not used. Open	O	TTL
26	GND	GND	GND terminal	I	(0V)
27	X1	X1	Crystal connection	I	----
28	X2	X2	Crystal connection	O	----
29	$\overline{EA}$	$\overline{EA}$	GND direct connection	I	TTL
30	$\overline{RESET}$	$\overline{RESET}$	CPU reset input; L: ON	I	----
31	$\overline{WDTOUT}$	$\overline{WDTOUT}$	Watchdog timer error detect; L: error	O	TTL
32	PA0		Not used. Open	O	TTL
33	PA1		Not used. Open	O	TTL
34	PA2/TO1		Not used. Open	O	TTL
35	PA3		Not used. Open	O	TTL
36	PB0/INT4		Not used. Open	I	TTL
37	PB1		Not used. Open	O	TTL
38	PB2		Not used. Open	O	TTL
39	PB3	RPFCOM	Receipt paper feed motor common power supply; H: ON	O	TTL
40	PB4/INT6		Not used. Open	I	TTL
41	PB5	AC_1	Auto cutter drive signal 1	O	TTL
42	PB6	AC_2	Auto cutter drive signal 2	O	TTL
43	PB7	AC_RST	Auto cutter position detect (reset)	I	TTL
44	VCC	VCC	Main power supply terminal (+5V)	I	(+5V)
45 46 47 48 49 50 51 52	D0 D1 D2 D3 D4 D5 D6 D7	D0 D1 D2 D3 D4 D5 D6 D7	Data bus	3 state	TTL
53	P10	RNE	Receipt paper near end detect; H: paper out	I	TTL
54	P11	R_COVER	Receipt printer cover open detect; L: close	I	TTL
55	P12	RCPT_FD_SW	Receipt paper feed switch; L: ON	I	TTL
56	P13	DK_S	Drawer open/close; L: open	I	TTL
57	P14	ROUT_LED	Receipt roll paper out LED; L: ON	O	TTL
58	P15	PTLED_COM	Receipt paper detect LED drive signal; L: ON	O	TTL
59	P16	RERR_LED	Receipt printer error LED; L: ON	O	TTL
60	P17	HCTS	HOST I/F HCTS	O	TTL
61 62	GND	GND	GND terminal	I	(0V)

CPU signal assignments and functions (continued)

No.	Pin name	Signal name	Function	I/O	Level
64 65 66 67 68	A23 A22 A21 A20 A19	A23 A22 A21 A20 A19	Address bus. Not used. Open Address (A19 to A323)	O	TTL
69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87	A18 A17 A16 A15 A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1 A0	A18 A17 A16 A15 A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1 A0	Address bus	O	TTL
88	$\overline{RD}$	$\overline{RD}$	External data read signal	O	TTL
89	$\overline{WR}$	$\overline{WR}$	External data write signal	O	TTL
90	P52		Not used. Open	I	TTL
91	P53		Not used. Open	I	TTL
92	P54		Not used. Open	I	TTL
93	P55		Not used. Open	I	TTL
94	CSO	CSO	Gate array select signal; L: ON	O	TTL
95	VCC	VCC	Main power supply terminal (+5V)	I	(+5V)
96	CS1	CS1	RAM chip select signal; L: ON	O	TTL
97	CS2	CS2	ROM (U6) chip select signal; L: ON	O	TTL
98	CS3	CS3	ROM (UN10) chip select signal; L: ON	O	TTL
99	RAS	RAS	Not used. Open	O	TTL
100	GND	GND	GND terminal	I	(0V)

RAM (1M bit)

RAM is used for temporary storage of the following:

- ❑ Data received from the interface (receive buffer)
- ❑ Pattern data printed by the print head unit (printer buffer)
- ❑ Data used for CPU (U4) routines (flags, pointers, etc.)

ROM (2M or 4M bits)

A printer control program and character generator data is written into FLASH ROM (U6). The control program controls basic printer operations, and all CPU (U4) control is performed in accordance with this program.

Gate array

The gate array (U5) of this printer controls power to the impact head and thermal head. It is equipped with four 8-bit I/O ports, PS-RAM controller, and a +24V control time-limit circuit. The gate array has its own independent 8MHz external clock. The table below shows the function of each gate array pin.

Gate array signal assignments and functions

No.	Pin name	Signal name	Function	I/O	Level
1	TEST	TEST	Connected to GND	I	TTL
2	$\overline{\text{RAMCS}}$	$\overline{\text{RAMCS}}$	RAM chip select signal; L: ON	I	TTL
3	$\overline{\text{GACS}}$	$\overline{\text{GACS}}$	Gate array select signal; L: ON	I	TTL
4	$\overline{\text{WR}}$	$\overline{\text{WR}}$	Data write signal	I	TTL
5	$\overline{\text{RD}}$	$\overline{\text{RD}}$	Data read signal	I	TTL
6	$\overline{\text{PSCE}}$	$\overline{\text{PSCE}}$	PS-RAM (U-7) chip select signal; L: ON	O	TTL
7	VDD	VDD	Main power supply terminal (+5V)	I	(+5V)
8 9 10 11 12 13 14	A6 A5 A4 A3 A2 A1 A0	A6 A5 A4 A3 A2 A1 A0	Address bus	I	TTL
15	VSS	VSS	GND terminal	I	(0V)
16 17 18 19 20 21 22 23	D7 D6 D5 D4 D3 D2 D1 D0	D7 D6 D5 D4 D3 D2 D1 D0	Data bus	3 state	TTL
24	VSS	VSS	GND terminal	I	(0V)
25	VDD	VDD	Main power supply terminal (+5V)	I	(+5V)
26	PB7		Not used. Open	O	TTL
27	SW24V_1		Not used. Open	O	TTL
28	SW24V_2	SW24V2	Printer mechanism +24V time-limit power; H: ON	O	TTL
29	RTS	RTS	HOST I/F RTS L:ON	O	TTL
30	$\overline{\text{SCLK}}$	CLK IN/DTR	HOST I/F CLK IN/DTR	I	TTL
31	$\overline{\text{RESET}}$	$\overline{\text{RESET}}$	Reset input; L: ON	I	-------
32	VSS	VSS	GND terminal	I	(0V)

Gate array signal assignments and functions (continued)

No.	Pin name	Signal name	Function	I/O	Level
33	HEAD1		Not used. Open	O	TTL
34	HEAD2		Not used. Open		
35	HEAD3		Not used. Open		
36	HEAD4		Not used. Open		
37	HEAD5		Not used. Open		
38	HEAD6		Not used. Open		
39	HEAD7		Not used. Open		
40	VSS	VSS	GND terminal	I	(0V)
41	VDD	VDD	Main power supply terminal (+5)	I	(+5V)
42	HEAD8		Not used. Open	O	TTL
43	HEADCOM		Not used. Open	O	TTL
44	P13		Not used. Open	I	TTL
45 46 47	P12 P11 P10		Not used. Open	I	TTL
48	VSS	VSS	GND terminal	I	(0V)
49	XOUT	XOUT	Crystal connection.	O	
50	XIN	XIN	Crystal connection	I	------
51	VDD	VDD	Main power supply terminal (+5)	I	(+5V)
52	PC7	DSW18	DIP switch setting signal DSW1-8	I	TTL
53	PC6	DSW17	DIP switch setting signal DSW1-7		
54	PC5	DSW16	DIP switch setting signal DSW1-6		
55	PC4	DSW15	DIP switch setting signal DSW1-5		
56	PC3	DSW14	DIP switch setting signal DSW1-4		
57	PC2	DSW13	DIP switch setting signal DSW1-3		
58	PC1	DSW12	DIP switch setting signal DSW1-2		
59	PC0	DSW11	DIP switch setting signal DSW1-1		
60	VSS	VSS	GND terminal	I	(0V)
61	PD7	MSL2	Thermal (receipt) printer connected/not connected; H: connected	I	TTL
62	PD6	MSL1	Slip printer connected/not connected; L: not connected	I	TTL
63	PD5	DSW26	DIP switch setting signal DSW2-6	I	TTL
64	PD4	DSW25	DIP switch setting signal DSW2-5		
65	PD3	DSW24	DIP switch setting signal DSW2-4		
66	VSS	VSS	GND terminal	I	(0V)
67	VDD	VDD	Main power supply terminal (+5)	I	(+5V)
68	PD2	DSW23	DIP switch setting signal DSW2-3	I	TTL
69	PD1	DSW22	DIP switch setting signal DSW2-2		
70	PD0	DSW21	DIP switch setting signal DSW2-1		

Gate array signal assignments and functions (continued)

No.	Pin name	Signal name	Function	I/O	Level
71	PE7		Not used. Open	I	TTL
72	PE6		Not used. Open	O	TTL
73	PE5		Not used. Open	O	TTL
74	PE4		Not used. Open	O	TTL
75	PE3		Not used. Open	O	TTL
76	PE2			O	TTL
77	PE1			O	TTL
78	PE0			O	TTL
79	VSS	VSS	GND terminal	I	(0V)
80	PF7		Not used. Open	O	TTL
81	PF6		Not used. Open	O	TTL
82	PF5		Not used. Open	O	TTL
83	PF4		Not used. Open	O	TTL
84	PF3	PF3	Not used. Open	O	TTL
85	PG4	PG4			
86	PG3	PG3			
87	PG2	PG2			
88	PG1	PG1			
89	PG0	PG0			
90	VSS	VSS	GND terminal	I	(0V)
91	VDD	VDD	Main power supply terminal (+5)	I	(+5V)
92	RSCLK	RSCLK	Thermal head clock signal	O	TTL
93	RSI	RSI	Thermal head serial data signal		
94	RLT	RLT	Thermal head latch signal		
95	RSTB2	RSTB2	Thermal head strobe signal 2		
96	RSTB1	RSTB1	Thermal head strobe signal 1		
97	PF2	PF2	Not used. Open	O	TTL
98	PF1	DKD2	Drawer kick driver signal 2; L: ON	O	TTL
99	PF0	DKD1	Drawer kick driver signal 1; L: ON	O	TTL
100	VSS	VSS	GND terminal	I	(0V)

Reset circuit

The reset circuit protects against runaway CPU processing during unstable voltages immediately after power up, abnormal printing, and other unforeseen operation. Output of the OUT pin (PIN 6) of the reset IC (Us) is supplied to the CPU (U4) as a RESET input signal (PIN 30). The reset ICC (U2) monitors +5V voltage, and release the CPU reset when voltage rises above 4.5V, which enable printer operation. The reset IC (U2) C terminal (PIN 5) is connected to the reset signal (DSR signal or PIN 25 input signal) from the host interface, via DIP switch 2-7 or 2-8. Reset signals can be supplied power to cause reset IC output to become low, which resets the CPU.

Reset from the host interface differs in accordance with interface specifications, as shown below.

RS-232C interface specifications

Selection between two signals (DSR signal or PIN 25 input signal) is possible.

1284 parallel interface specifications

Always use the #25 RESET signal. DIP switch 2-8 is always on. With the 1284 parallel interface, this printer can be reset from the host interface signal's nInit signal (PIN 31).

M-T88 Control Circuit

Thermal head drive circuit

The print head of the receipt printer mechanism is a thermal type print head with 512 dots per line. All print head control is performed via a gate array. A driver is built into the print head, and sending of print signal RSI, which is synchronized with the RSCKL signal, to the driver sets the print/non-print status of each dot. Data is confirmed by latch signal RLT. Print time control is performed by RSTB1 and RSTB2, while energizing time is controlled by the gate array.

Changes in head temperature causes fluctuation of the resistance value of the thermistor built into the head, which is output as temperature signal THR. This signal is read by the analog port of the CPU (U4).

Paper feed motor drive circuit

The paper feed motor has a precise angle of rotation (highly precise movement amount), and allows control of motor speed. When RPFCOM signal of the CPU (U4) goes H, +24V are applied to the COM terminal of the paper feed motor coil, and RPF_+A, RPF_-A, RPF_+B, and RPF_-B change between H and L. The H/L change speed of RPF_+A, RPF_-A, RPF_+B, and RPF_-B determines the speed of the motor. RPFCOM signal of the CPU (U4) changes back to L after the paper feed operation is complete.

Auto cutter drive circuit

The auto cutter drive uses a TA8428K DC motor dedicated IC. Signals AC_1 and AC_2 from the CPU (U4) performs clockwise and counterclockwise operation, and braking of the auto cutter.

AC_1	AC_2	Operation
L	L	Off
H	L	Clockwise
L	H	Counterclockwise
H	H	Brake

Detector circuits

Paper end sensor circuit

The thermal printer mechanism is equipped with a paper end sensor, which is connected via switch circuit board assembly-B to the main circuit board unit-A. The paper end sensor is enabled when the PTLED_COM signal output from the CPU (U4) is on, and paper end signal RRE is input to the CPU's analog port.

Cover open sensor circuit

The cover open sensor is located next to the thermal printer mechanism, and it is connected via switch circuit board assembly-B to the main circuit board unit-A. Detector signal R_COVER is input to the CPU (U4).

Near end sensor circuit

The near end sensor is located next to the thermal printer mechanism and the roll paper holder. It is connected via switch circuit board assembly-B to the main circuit board unit-A. Detector signal RNE is input to the CPU (U4).

Control Panel Control Circuit

This control panel is located on switch circuit board assembly-B. It has three LEDs (POWER, ERROR, RECEIPT OUT) and one switch (FEED). The POWER LED drives when +5V is supplied by the power circuit. The ERROR and RECEIPT OUT LEDs are controlled by the CPU (U4). Switch sensing is performed by the CPU (U4) (switch sensing signal is input to CPU port).

DIP Switch Read Circuit

There are a total of 14 DIP switches in banks DSW1 (switches 1 to 8) and DSW2 (switches 1 to 6). Low level is read when a switch is ON and high level is read when a switch is off.

Malfunction Protection Circuit

The malfunction protection circuit protects against continuous energizing of the printer mechanism due to runaway processing by the CPU, etc. The following are the causes to activate the malfunction protection circuit:

- Output of the $\overline{\text{WDTOUT}}$ signal due to runaway processing by the CPU.
- Output of SW24V_2 signal from the gate array (U5) due to runaway processing by the CPU.
- TIMI signal output when abnormal continuous output to paper feed motor drive circuit is detected.
- TIMI signal output when print head temperature is abnormally high.

When any of the above triggers occurs, power supply to the printer mechanism is turned off (Q5 OFF) in order to protect the printer mechanism.

Drawer Kick Control Circuit

Signals DKD1 and DKD2 from gate array (U5) going active cause transistors Q7 and Q6 to turn on, which in turn turns on transistor array QM1, outputting the drawer drive signal. The DK_S signal, which indicates whether or not the drawer is open, is input to the CPU (U4), and this status can be obtained from the host interface. The drawer power supply of +24V is supplied via the regulator IC (U8), and the power supply is cut whenever over current or over duty occurs.

Power Supply Circuit

The table below shows supply voltage values and their applications.

Power Supply Voltage Values and Applications

Voltage Value	Main Applications
+5V (Vcc)	Logic circuit power supply
	Interface board power supply
	Control panel circuit power supply
	Detector power supply
	Thermal head logic circuit power supply
	Malfunction circuit logic power supply
	Cover open sensor power supply
+24V	Printer mechanism power supply Paper feed motor Thermal head Auto cutter
	Drawer kick driver power supply

Filter Circuit

A +24C DC (24 ±7%) power supply is input from connector CN1 after passing through the filter circuit. The filter circuit reduces external noise and protects against noise that is generated internally from escaping through the +24V DC power supply.

+24V Control Circuit

The +24V power supply that from the filter is split between the printer power supply and +5V (regulator circuit).

TM-T88 Power Supply

The +24V power supply is completely supplied through a FET (Q5). The FET (Q5) controls the output condition (+24V output on/off) in accordance with signal SW24V_2, which is output from the gate array (U5). The signal SW24V_2 is a circuit protection signal for the +24V system.

If abnormal voltage is detected, if the CPU detects an error, or if a CPU abnormality is detected, the FET automatically turns off and +24V output is stopped. +24V output is OFF during system reset and if +24V is not being used by the printer mechanism.

+5V Control Circuit

A +5 regulator circuit switches the input +24V power supply and converts it to +5V. The switching regulator IC (U9) switches the input +24V, C50 and L3 perform smoothing, and +5V voltage is output.

The RS-232 power supply is generated by a charge up circuit built into the RS-232 interface's onboard driver.

I/F Circuit Board Assembly

This printer uses a TM Series universal interface, which allows support of a variety of different interfaces by changing the interface board.

I/F Circuit Board Assembly Types

- ❑ EIA-TIA RS-232 Interface (built into TM-T88)
- ❑ IEEE 1284 Interface (built into TM-T88P)
- ❑ EIA/TIA RS-485 Interface (option)

Interface Board Structure

The I/F circuit board assembly has the following built-in electrical circuits:

- ❑ Reset circuit (except RS-485 interface)
- ❑ Host interface circuit

For details on each type of interface, see the interface board circuit diagrams in the appendix at the end of this document.

Switchboard B

Switchboard set B has the following built-in electrical circuits:

- ❑ Paper feed switch
- ❑ LED (power, error, roll paper out)
- ❑ Receipt mechanism interface (wired junction only)

Chapter 3
Handling, Maintenance, and Repairs

Handling

Transport Precautions

Take the following steps to protect the unit against vibration and impact whenever transporting it:

⚠ CAUTIONS:

- ❑ *We recommend that each unit be packed individually in the boxes.*
- ❑ *Remove the paper from the unit.*
- ❑ *Make sure that the roll paper cover is securely closed.*

Setup Precautions

Note:
The cover of the unit is secured in place with tape. Remove the tape before using the unit.

Operational Precautions

Observing the following operational precautions protects the unit against damage.

⚠ CAUTIONS:

- ❑ The back of the unit is equipped with a grounding screw. Be sure to use this screw to ground the unit before using it.
- ❑ Connect the interface cable, power cable, and drawer cable to the applicable connectors of the unit. Do not use undue force when plugging cables into connectors.
- ❑ Do not turn unit power off during normal operation. Be especially careful to avoid turning power off while a paper cut operation is being performed. Doing so can result in the cutter blade being exposed, which will make it impossible to open the roll paper cover.
- ❑ Never pull out paper while the roll paper cover is open.
- ❑ During normal operation, never open the cutter cover and rotate the cutter manual knob by hand. Doing so can cause the cutter blade to be exposed, making it impossible to open the roll paper cover.

- ❑ The heating element of the printer mechanism's thermal head and the driver IC are easily damaged. Never allow these components to come into contact with metal or other hard objects.

- ❑ Never touch the printer mechanism's (thermal head's) heating element with your hand. Doing so can soil the heating element and affect proper operation.

- ❑ The head and motor areas are very hot during and immediately after printing. Do not touch components in these areas directly with your hand.

Paper Precautions

⚠ CAUTIONS:

- ❑ Be sure to use only paper that conforms with the specifications in the preceding section of this manual. Thermal paper that includes Na, K, or C1 ions can affect proper operation of the thermal head's heating element.

- ❑ Thermal paper starts to color at around 70°C. Take care to protect unused and printed thermal paper against the effects of heat, light, and humidity, which can cause the paper to color and characters on the paper to fade.

- ❑ Take the roll paper out of the printer when you will not use the printer for a long time in a high temperature and humidity environment.

- ❑ Do not use this unit to print on label paper.

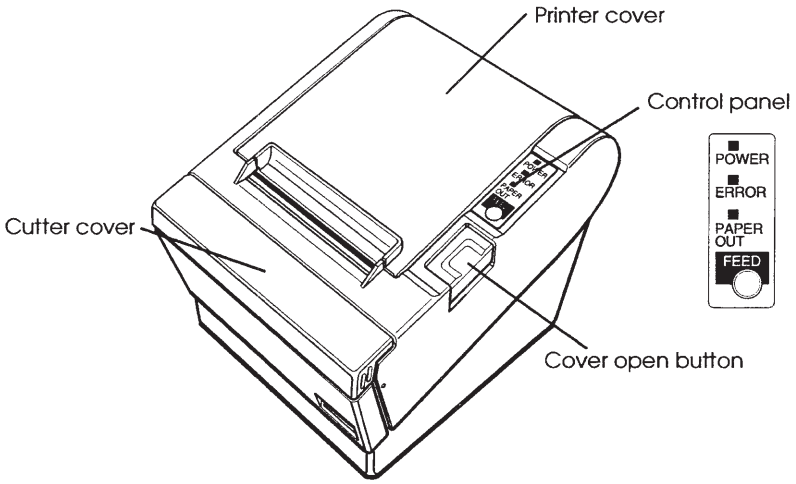
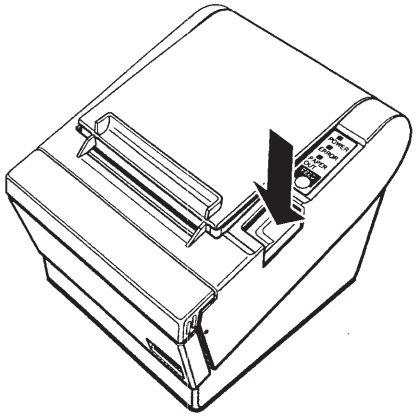


Figure 3-1

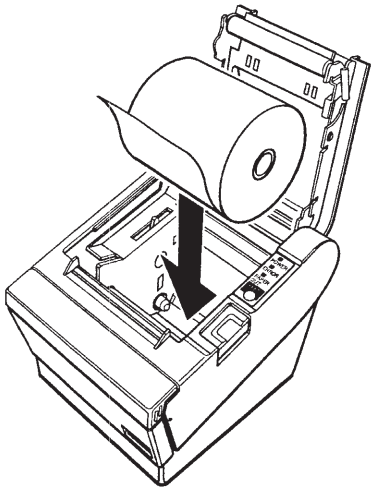
Loading roll paper

Note:
Be sure to use paper rolls that meet the specifications. Do not use paper rolls that have the paper glued to the core because the printer cannot detect the paper end correctly.

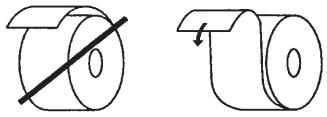
1. Make sure that the printer is not receiving data; otherwise, data may be lost.
2. Open the paper roll cover by pressing the cover-open button. If the cover-open button will not open the cover, see page 3-7.



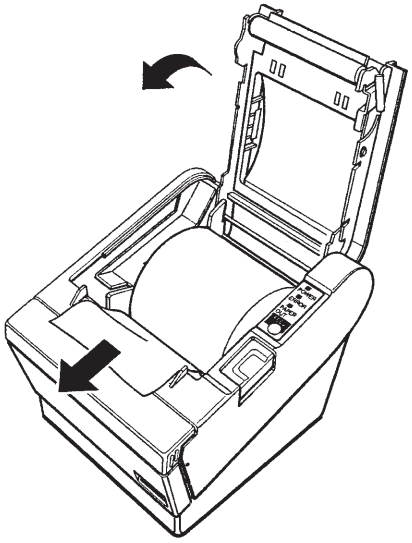
3. Remove the used paper roll core if there is one.
4. Insert the paper roll as shown.



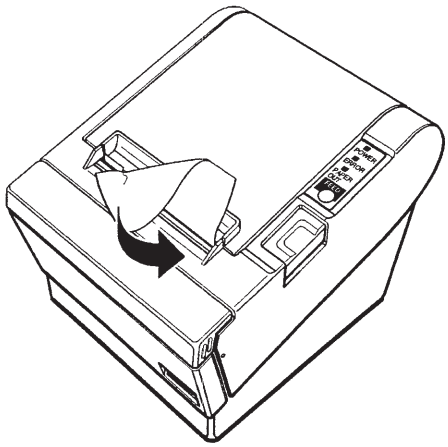
5. Be sure to note the correct direction that the paper comes off the roll.



6. Pull out a small amount of paper, as shown. Then close the cover.



7. Tear off the paper as shown.



Remaining roll paper adjustment (adjusting the paper near end sensor)

This sensor has two settings, which are the lower and upper positions. This sensor is set to the lower position at the factory. If you find that there is not enough paper remaining on the roll when the near-end sensor is triggered, you can change the setting to the upper position as described below.

Note:
The factory setting is based on a paper roll core with an outside diameter of 18mm and an inside diameter of 12mm. If you use a paper roll with a core with an outside diameter of more than 18 mm, it is better to change to the upper position as described below.

1. Open the paper roll cover, and remove the paper roll.

2. Loosen the adjustment screw with a coin or flathead screw driver.

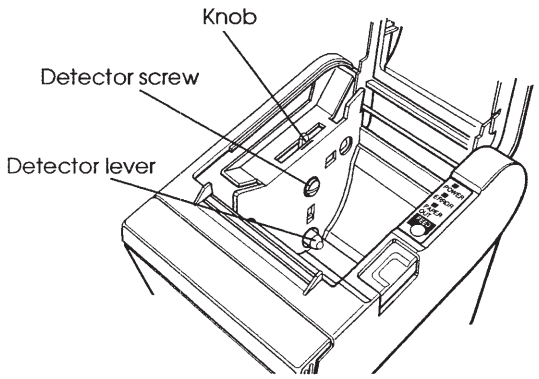


Figure 3-2

3. Move the tab up to the upper position.
4. Tighten the adjustment screw, and check to be sure that the detecting lever moves freely.
5. Replace the paper roll.

Note:
For your reference, this shows the diameter at which the near-end sensor is triggered. Note that this figure is a calculated value, and there may be some variations depending on the printer.

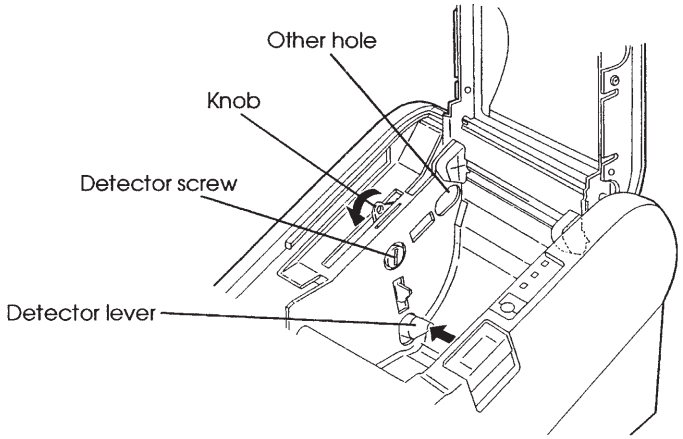
Position	Trigger point (diameter of paper roll)
Lower position	About 23mm
Upper position	About 27mm

About the mounting position of the paper near end sensor

This printer has a function to allow you to change the mounting position of the paper near end sensor. This function is used when you mount the printer on a wall.

This is the procedure to change the mounting position:

1. Loosen the detector screw with a coin or similar tool. Turn the screw at least 3 or 4 times.
2. Push the detector lever in until it touches the back of the hole.
3. While pushing the lever, turn the knob toward you until the detector lever clicks into place in the other hole.
4. While pressing the knob toward you, secure the detector screw.
5. Make sure the detector lever moves smoothly.



Note:

To use the printer mounted on a wall, you need the optional Wall Hanging Bracket: Model WH-10. This is a kit that contains roll-paper stoppers, brackets, screws for brackets, a wall mount, an operation panel sheet, and an installation manual.

Using the power switch cover

⚠ WARNING:

If an accident occurs when the power switch cover is attached, unplug the power supply cord from the outlet immediately. Continued usage may lead to fire or shock.

You can use the power switch cover to make sure that the power switch is not accidentally pressed. If you want to use this cover, install it as shown in the illustration below.

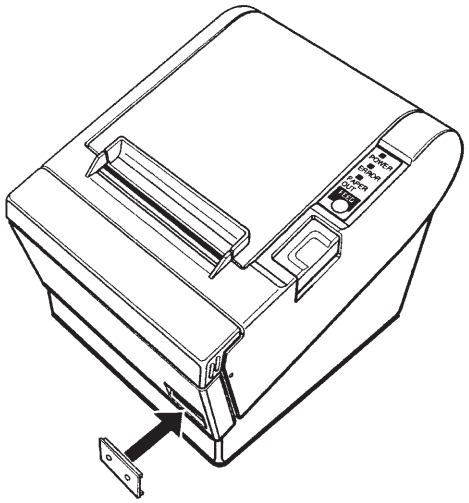


Figure 3-3

To remove it, use a flathead screw driver or similar tool.

You can turn on or off the power switch using the two holes on the cover. Insert a pointed object into the holes and press the power switch.

Problem Solving

Errors

See Chapter 4, *Error Types and Processing.*

Roll paper cover does not open (roll paper cover button does not work)

1. Open the auto cutter cover.
2. Then turn the knob until you see ▼ in the opening, as shown in the illustration below. This returns the cutter blade to the normal position. Also notice that there is a label near the cutter to assist you.

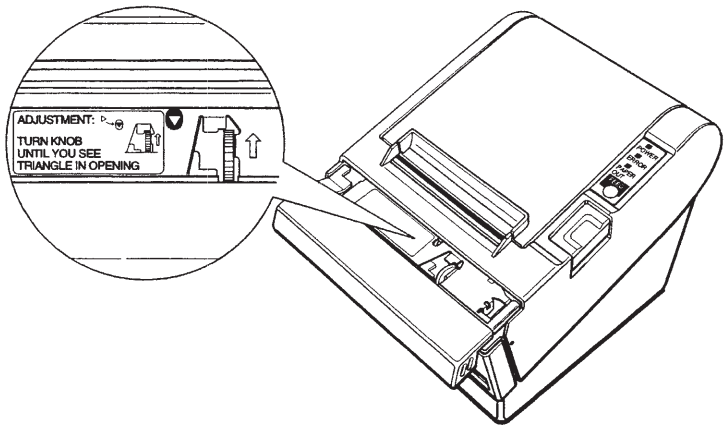


Figure 3-4

3. Close the cutter cover.
4. Pull up the roll paper cover by hand.

Notes:
Other than a paper jam, the auto cutter locking up could have been caused by a foreign object such as a push pin or paper clip. If this is the case, follow the same procedure described above to return the cutter to its normal position.

Do not open the cutter cover unless you find that the roll paper cover does not open.

Clearing Paper Jams

⚠ CAUTIONS:

Take care not to let metal objects come into contact with the thermal head. Metal can damage the head.

Do not touch the thermal head or radiation plate. Printing can cause them to become very hot.

1. Open the roll paper cover.

   Note:
   See the previous section for steps to take if the roll paper cover does not open.

2. Next, turn power off.

3. Grasp the leading end of the receipt paper and pull the jammed paper.

   Note:
   Be sure to remove all of the paper. Leaving part of the paper in the unit can cause sensor malfunction.

4. Correct the problem that caused the paper jam and reload the roll paper into the unit.

   Note:
   See the section "Loading roll paper" for details on how to load roll paper.

Inspection and Maintenance

Proper performance of the inspection and maintenance procedures described below makes it possible for this unit to perform for the years of trouble-free operation for which it is designed.

Maintenance Procedures

The inspection procedures described here are divided between two types: daily inspection, which can be performed by the individuals who use the unit on a daily basis, and periodic inspection, which should be performed by individuals who have a more detailed technical knowledge of the unit.

	Inspection item	Action
Setup	Check for proper connection of cables.	Reconnect any cables that have come loose.
	Check for proper installation of roll paper.	Correctly install roll paper.
	Make sure the roll paper cover and cutter cover are closed.	Close all covers.
Paper particles, paper scraps, foreign matter	Open the roll paper cover and make sure there are no large pieces of paper or other foreign matter present.	Clean out any paper or foreign matter.

	Inspection item	Action
Dirt, lint and dust inside components	Check for dirt, lint, and dust in the paper path.	Use a vacuum cleaner to completely remove all dirt, lint, and dust.
	Check for any foreign matter on the surface of or in the paper end sensor.	Wipe away foreign matter with paper or some other soft material.
	Check if the platen roller has become white with paper particles.	Wipe off the roller moistened with water.
Springs	Check the frame shutter spring and all other springs for deformation and disconnection.	If a problem is discovered, correctly install the spring or replace it with a new one.
Lubrication	Check to make sure that all components are properly lubricated.	Lubricate any component as required.
Operation	Check for abnormal noise during operation and any abnormal printing.	Correct any problems in accordance with the Troubleshooting Guide in chapter 4.

Cleaning

Thermal head

⚠ CAUTIONS:

- ❑ *Turn off the printer power before cleaning.*
- ❑ *Note that the thermal head (thermal element and radiation plate) becomes very hot during normal operation, creating the danger of burn injury. Be sure to wait for about 10 minutes after turning printer power off before beginning the cleaning.*

1. Open the paper roll cover.
2. Clean the thermal element (the area that looks like it is marked with a thin black line) of the thermal head with a cotton swab moistened with an alcohol solvent (ethanol, methanol, or IPA).

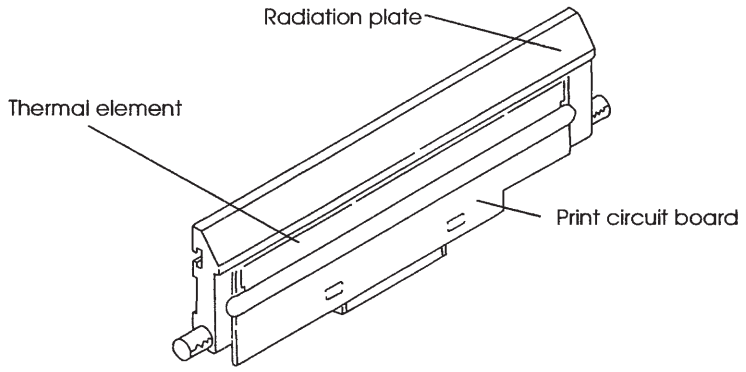


Figure 3-5

⚠ CAUTION:

Never touch the thermal element with your hand. Doing so can damage the thermal element.

3. After confirming that the alcohol solvent has been dried up completely, close the paper roll cover.

Platen roller on receipt side

Wipe the platen roller surface with a cotton swab moistened with a little water while rotating the platen roller gear.

Paper roll end sensor on receipt side

Clean the paper roll end sensor with a cotton swab moistened with a little water.

Exterior dirt

Use a clean, dry cloth to wipe off dirt from the exterior of the unit. If this does not get the unit clean, wipe with a cloth moistened with a small amount of water or a solution of water and a mild neutral detergent.

⚠ CAUTION:

Do not use alcohol, benzene, thinner, trychloroethylene, ketone or other similar agents for cleaning. Such agents can cause deformation, deterioration, and damage to plastic and rubber components.

Dirt, lint, dust

Use a vacuum cleaner to completely remove all dirt, lint, and dust.

⚠ CAUTION:

After vacuuming, check all components for proper lubrication. If lubrication is deteriorated or low, wipe it away and re-lubricate.

Lubricants

Lubrication is critical to retaining the printer at its initial performance level throughout its product life, as well as avoiding potential problems. Always lubricate at prescribed intervals, using the correct lubricants. Also lubricate each time you clean any parts.

Lubrication Standard

- ❑ Always lubricate whenever you assemble or replace the parts even if the time for lubrication has not been reached.
- ❑ Also lubricate if you wipe out the lubrication during cleaning even if the time for lubrication has not been reached.
- ❑ To lubricate, clean the parts first to remove old lubrication; then lubricate them.

Type of Lubricants

The types of lubricants used greatly affect the printer's performance and durability. Therefore, use the correct lubricants prescribed in the manual. The prescribed lubricants are available in 40cc (40 gm) metal cans or plastic containers (the smallest unit of supply).

Lubricants used in the TM-T88 Series
G-15
G-19

Lubrication points

See Lubrication Points Diagram section in the Appendix.

Tool list

The required tools for this printer are as follows:

- ❑ Brush #1
- ❑ Cleaning brush
- ❑ Phillips screwdriver No.1
- ❑ Phillips screwdriver No.2
- ❑ Flatblade head screwdriver
- ❑ Screwdriver with torque meter (cross head screwdriver)
- ❑ Hex screwdriver
- ❑ Retaining pliers
- ❑ Thickness gauge
- ❑ Tweezers
- ❑ Slanted blade cutter
- ❑ Pliers
- ❑ Electric soldering iron
- ❑ Grounded wrist band

Measuring equipment list

Name	Standard
Tester	DC voltage maximum 400V and resistance measurable
Oscilloscope	With 500 Mhz storage
Tension gauge	

Lubricant list

Type/Name	Quantity
Grease / G-15	40gr
Grease / G-19	40gr

Chapter 4
Troubleshooting Guide

The following tools make it easy to determine the cause of any problems that occur.

Self-test

This procedure tests control circuitry (other than serial communication and parallel communication send/receive control) and the printer mechanism.

Troubleshooting flowcharts

These flowcharts guide you through analysis of problems on a unit-by-unit basis. Their attention to fine detail helps to locate the causes that are normally difficult to determine.

Self-test

Performing the Self-test

1. Prepare the unit for printing by loading roll paper and closing the roll paper cover.
2. While holding down the feed button on the control panel, turn on unit power. Release the paper feed button once printing starts.
3. The PAPER OUT LED starts to flash when the printing operation is complete.

   The content of the printout shows the current status of the printer. To continue the self-test, press the paper feed button again.

Self-test End

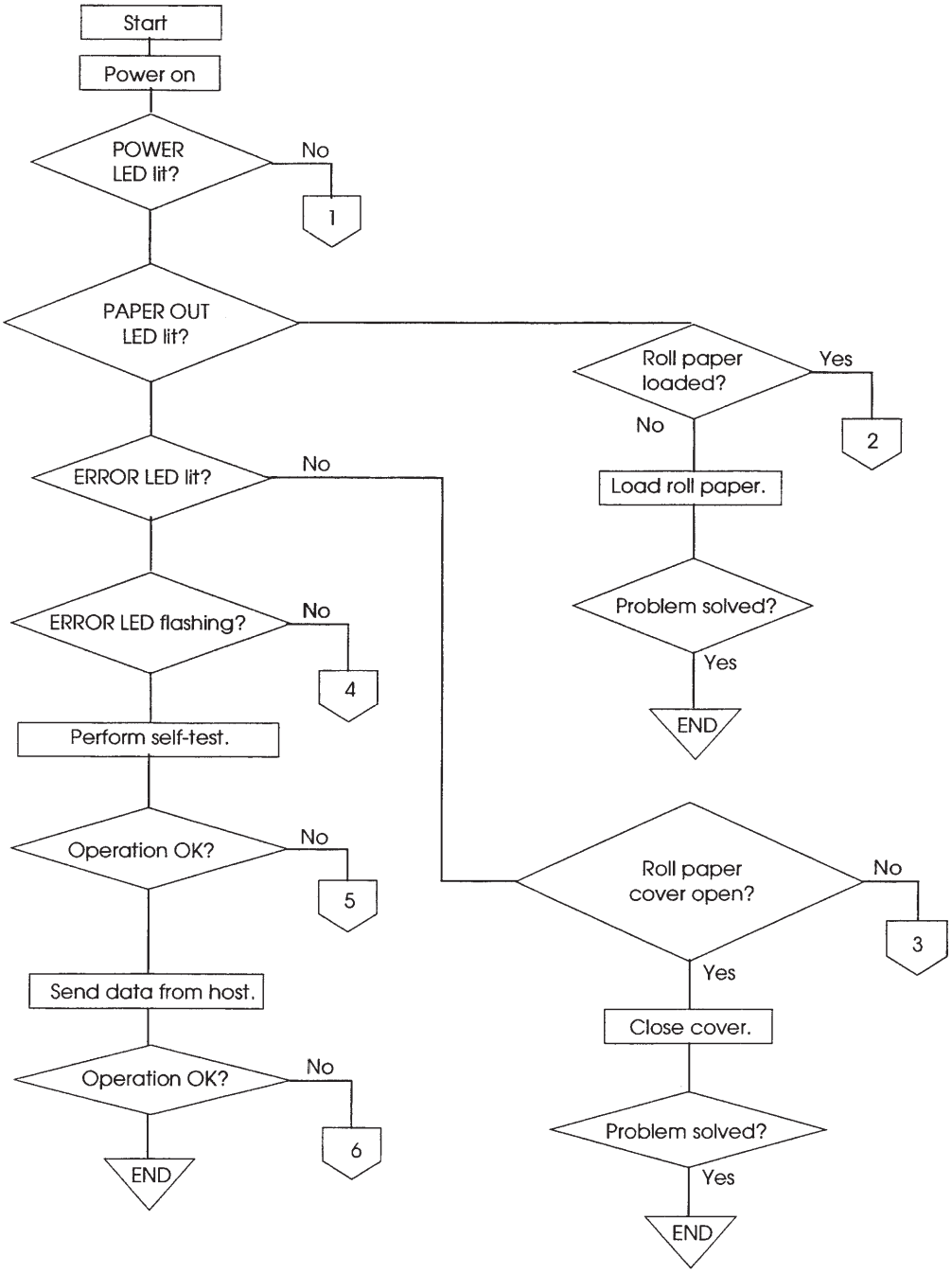
The following is printed as the final line of a self-test:

*** completed ***

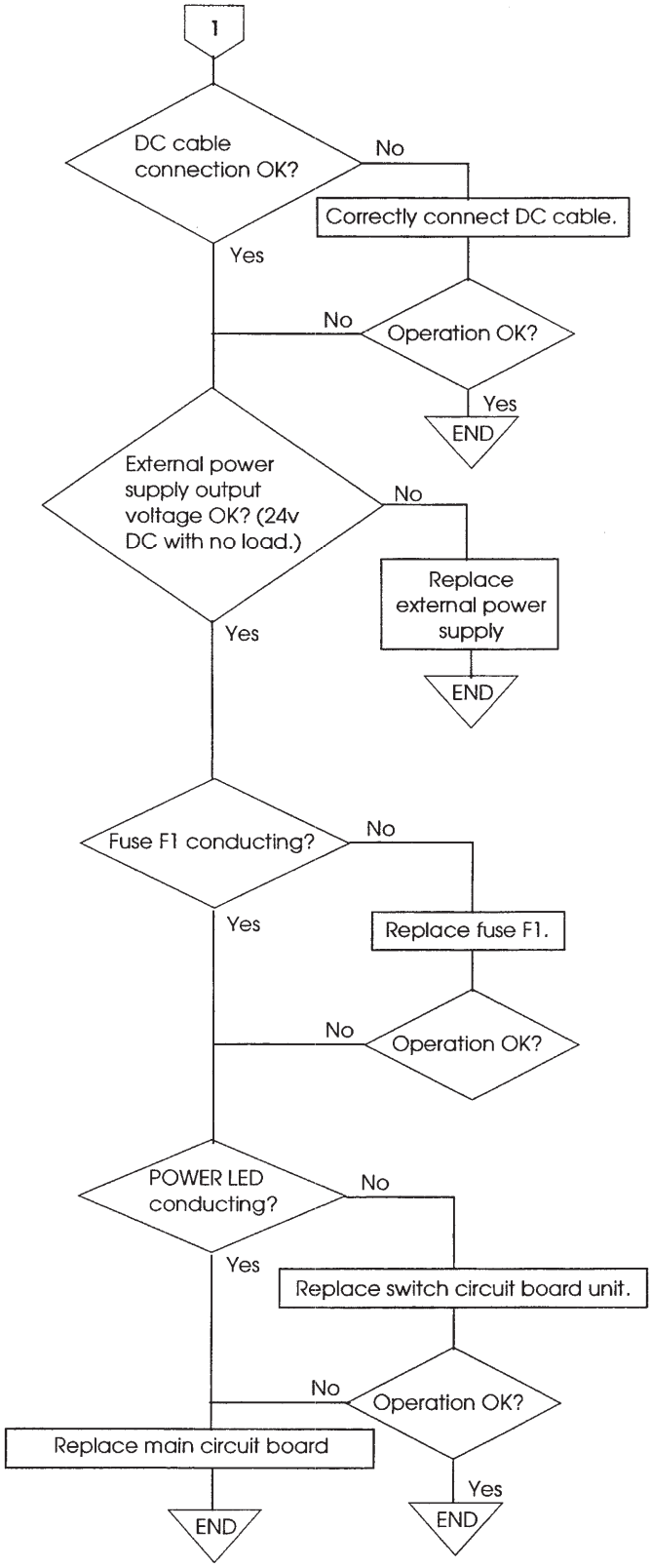
The unit then enters the normal operational mode, with all settings initialized.

Troubleshooting Flowcharts

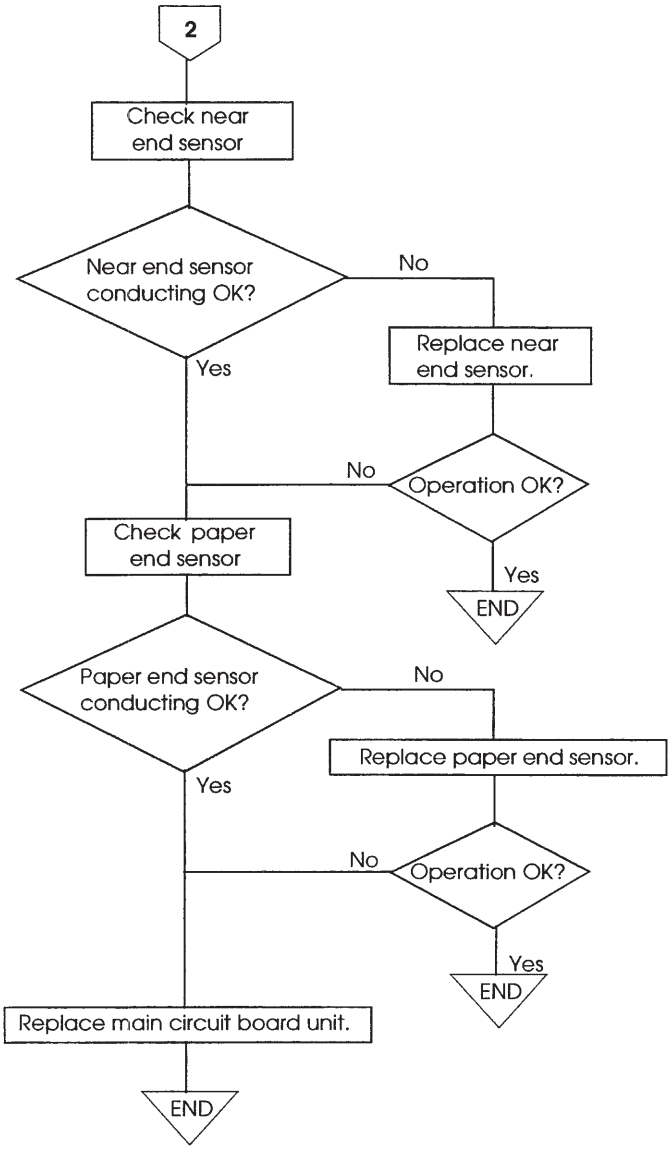
The troubleshooting flowcharts help to locate the causes of problems that are not immediately apparent.



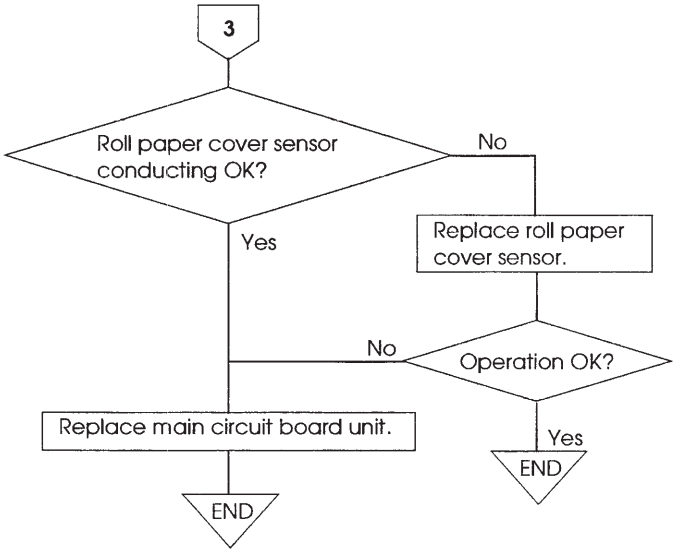
1 POWER does not turn on.



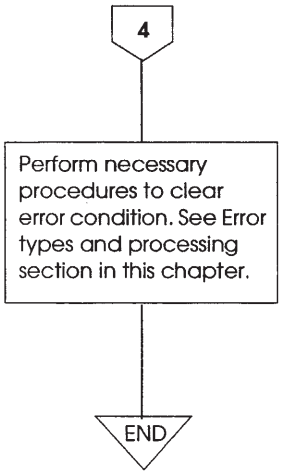
2 PAPER OUT LED does not light.



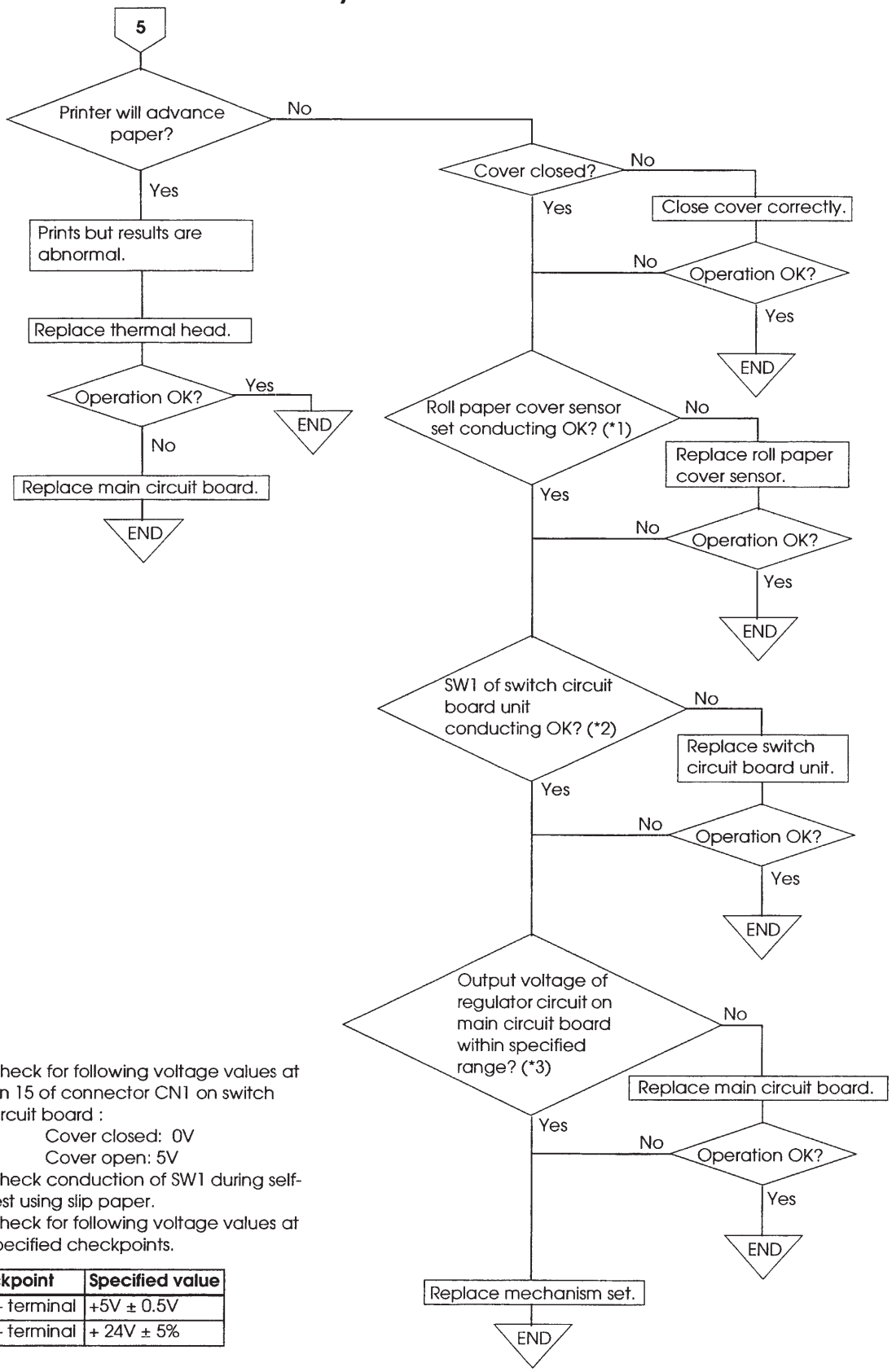
3 ERROR LED is lit.



4 ERROR LED is flashing.



5 Self-test does not work correctly.



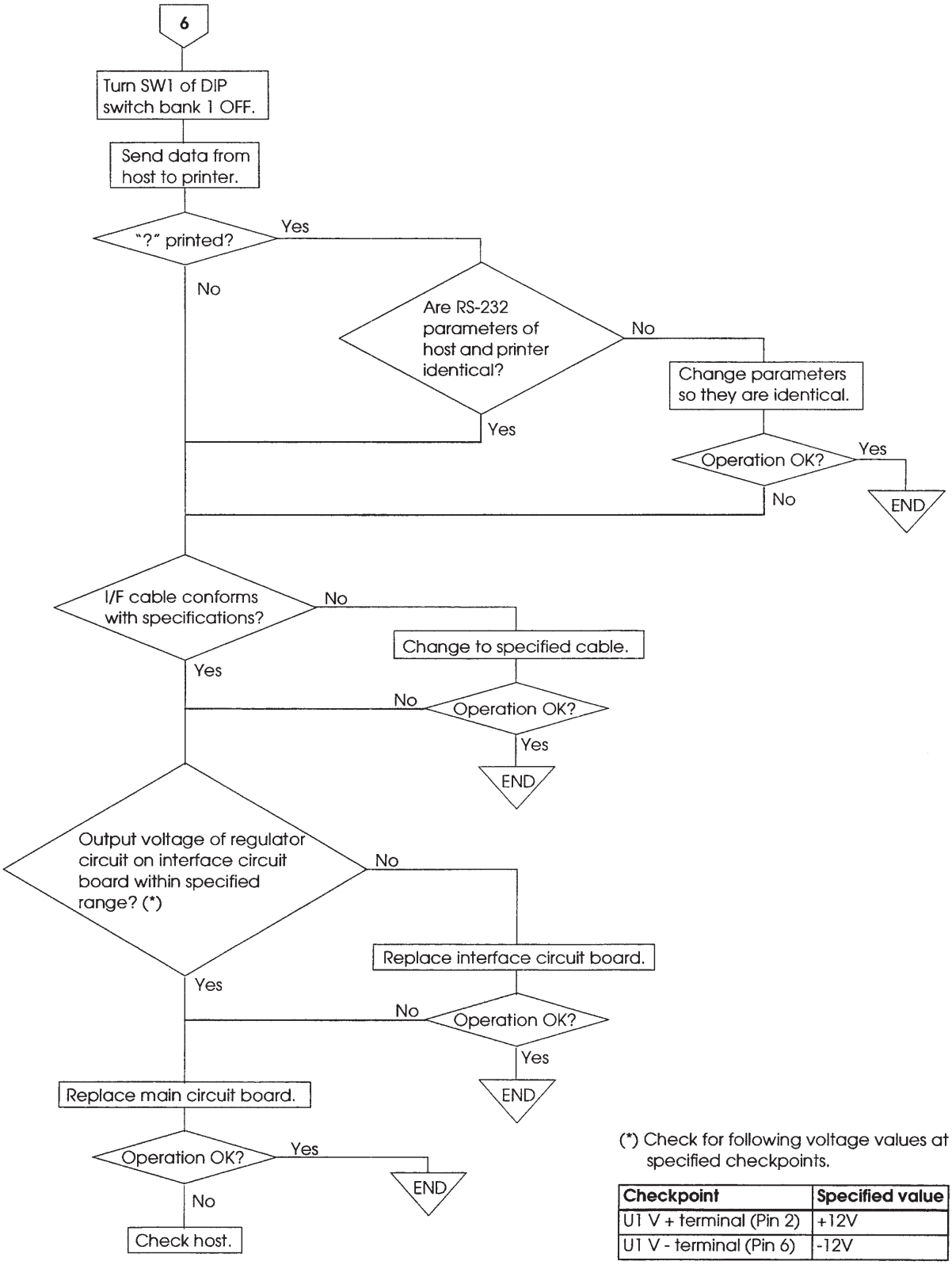
(*1) Check for following voltage values at Pin 15 of connector CN1 on switch circuit board :
Cover closed: 0V
Cover open: 5V

(*2) Check conduction of SW1 during self-test using slip paper.

(*3) Check for following voltage values at specified checkpoints.

Checkpoint	Specified value
C42 + terminal	+5V ± 0.5V
C39 + terminal	+ 24V ± 5%

6 Data from host is not printed correctly. (For RS-232 interface)



(*) Check for following voltage values at specified checkpoints.

Checkpoint	Specified value
U1 V + terminal (Pin 2)	+12V
U1 V - terminal (Pin 6)	-12V

Error Types and Processing

Error types

Errors that automatically recover

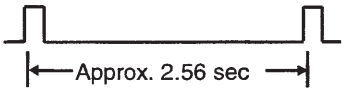
Table 4.1 Errors That Automatically Recover

Error	Description	ERROR LED Blinking Pattern Approx. 160 msec	Recovery
Print head temperature error	The temperature of the print head is extremely high.		Recovers automatically when the print head cools.
Cover open error	Printing is not performed correctly due to a cover open		Recovers automatically when cover is closed.

Note: Print head temperature error is not an abnormality.

Errors that have the possibility of recovery

Table 4.2 Errors That Can Possibly Recover

Error	Description	ERROR LED Blinking Pattern Approx. 160 msec	Recovery
Auto cutter error	The auto cutter does not work correctly.		Recovers by **DLE ENQ 1** or **DLE ENQ 2**.

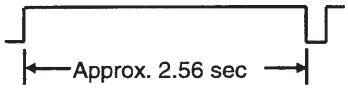
Note: If the paper jams, turn the printer off and remove jammed paper; then turn the printer on again.

Errors that are impossible to recover

⚠ CAUTION:

When any error shown below occurs, turn off the power as soon as possible

Table 4.3 Unrecoverable Errors

Error	Description	ERROR LED Blinking Pattern Approx. 160 msec	Recovery
R/W error in memory or gate array	After R/W checking, the printer does not work correctly.		Impossible to recover.
High voltage error	The power supply voltage is extremely high.		Impossible to recover.
Low voltage error	The power supply voltage is extremely low.		Impossible to recover.
CPU execution error	The CPU executes an incorrect address.		Impossible to recover.
Internal circuit connection error	Internal circuits are not connected correctly.		Impossible to recover.

Printer Operation when an Error Occurs

The printer executes the following operations when detecting an error.

- Stops all printer operations.
- Goes BUSY (when DIP switch 2-1 is off).
- Blinks the ERROR LED.

Data Receive Error (only with the serial interface model)

If one of the following errors occurs during serial interface communications, the printer prints "?" or ignores the data, depending on the setting of DIP switch 1-1.

- Parity error
- Framing error
- Overrun error

Chapter 5
Disassembly, Assembly, and Adjustment

Before starting disassembly, assembly, and adjustment

Be sure to observe the following important points whenever performing disassembly, assembly, or adjustment.

⚠ CAUTION:

Disconnect the power supply unit from the printer before beginning work. Current continues to flow through internal circuitry even when the printer's power switch is turned off. Performing work without disconnecting the power supply can cause serious damage to the printer.

Disconnect all peripherals connected to the printer before beginning work.

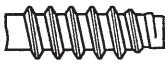
Perform all disassembly in accordance with the procedures in this manual. Incorrect disassembly can cause serious damage to the printer.

Never touch an FPC or its connectors with your fingers. Getting dirt on the FPC or its connectors can result in improper connection.

Small Parts

This section lists the names and terms used in this manual when referring to screws and other small parts.

Terms	Names
CBS-tite	Cross-recessed Binding head S-tite self-tapping screw
CPS-tite	Cross-recessed Pan head S-tite self-tapping screw
CPS-tite(O)	Cross-recessed Pan head S-tite screw with outside toothed lock washer
CBB-tite	Cross-recessed Binding head B-tite self-tapping screw
CC	Cross-recessed Cup head screw
CB	Cross-recessed Binding screw
RE	Retaining Rings E-type

Head (top)	Head (side)	Body	Washer (assembled)
C (Cross)	P (Pan) B (Bind) C (Cup)	S-tite T-B  B-tite P-tite	(O)

Using This Manual

This section explains a number of general conventions used in this manual.

Titles

The titles that appear inside the sections of this manual describe the assembly and disassembly of major parts and blocks. Not all of the parts (service parts) are indicated as titles.

Disassembly, Assembly, and Adjustment Procedures

The procedures in this manual are arranged so the entire printer is disassembled when performed from beginning to end.

Disassembly of some parts and blocks may be impossible unless performed in accordance with the procedures described in this manual.

Perform the procedures in this manual from the end to the beginning to assemble the printer.

Names of Parts and Blocks

Part names are indicated by curly brackets { }, while the names of blocks (components that can be disassembled further) are indicated by square brackets [ ].

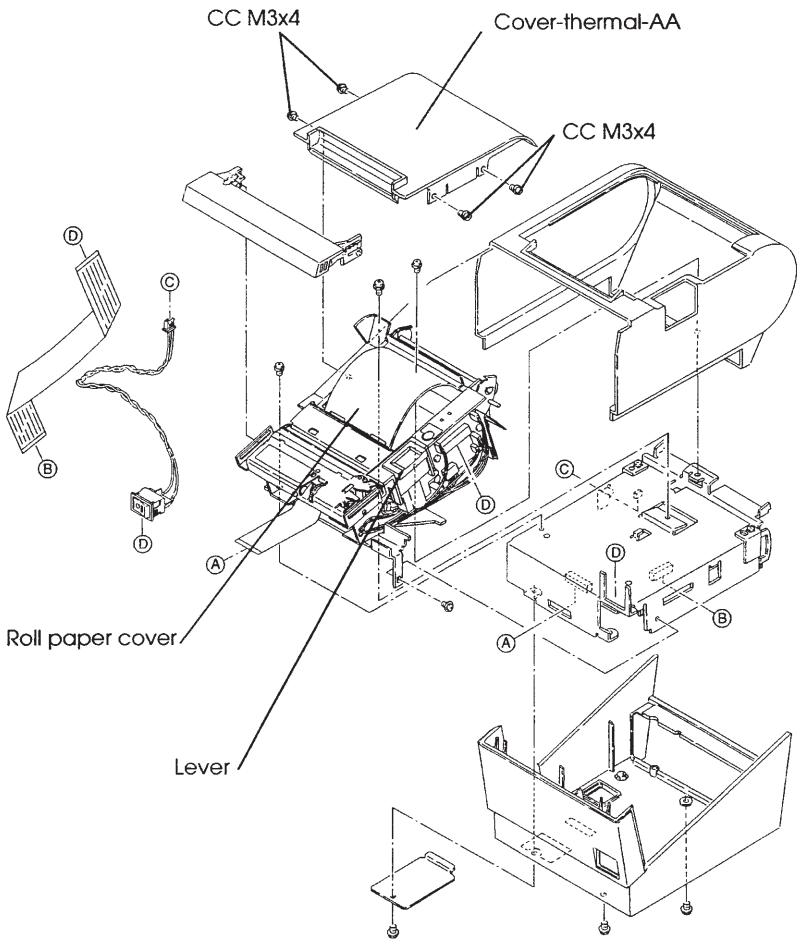
TM-T88 Series Disassembly, Assembly, and Adjustment

Level 1 Disassembly and Assembly

Cover-Thermal-AA

1. Press the lever and open the roll paper cover.
2. Remove the four {CC M3x4} screws.
3. Remove {cover-thermal-AA}.

   First detach the four dowels and then remove {cover-thermal-AA}.



To install, reverse the removal procedure.

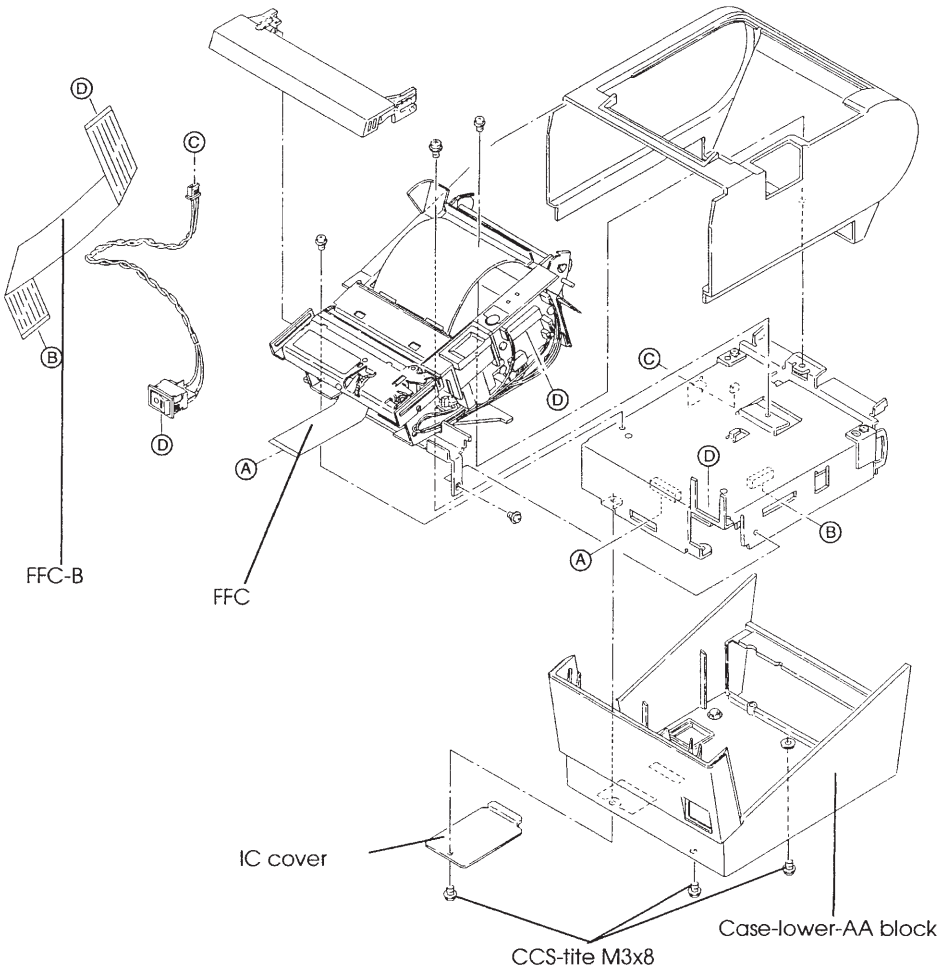
Case-lower-AA block

1. Remove the three {CCS-tite M3x8} screws.
2. Remove {IC cover}.
3. Remove [case-lower-AA block].

⚠ CAUTION:

During installation, make sure you do not pinch the {FFC} or {FFC-B} between the case and mechanism. Doing so can result in malfunction.

Note:
See page 5-8 for further disassembly and assembly of [case-lower-AA block].



To install, reverse the removal procedure.

Case-thermal-upper-AA

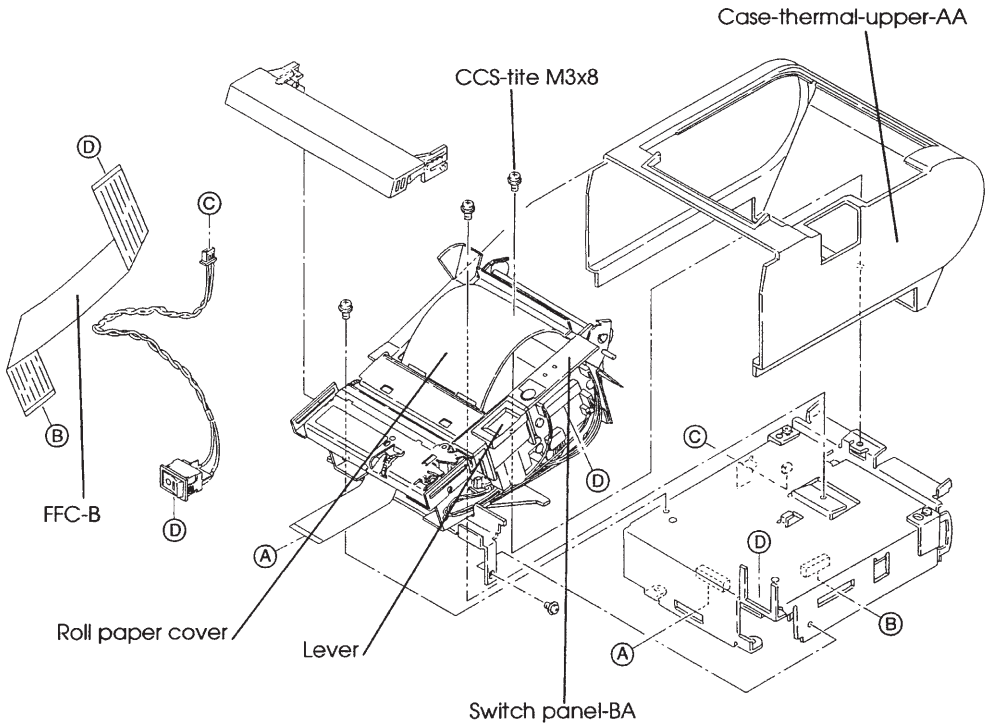
1. Press the lever and open the roll paper cover.
2. Remove the single {CCS-tite M3x8} screw.

   You will see three screws when you open the roll paper cover. Remove the one on the back of the printer.
3. Close the roll paper cover.
4. Slide off {case-thermal-upper-AA}.

   Remove {case-thermal-upper-AA} while pressing the lever to cause bending on the inside.

   Note:
   During installation, insert the {FFC-B} inside the case.

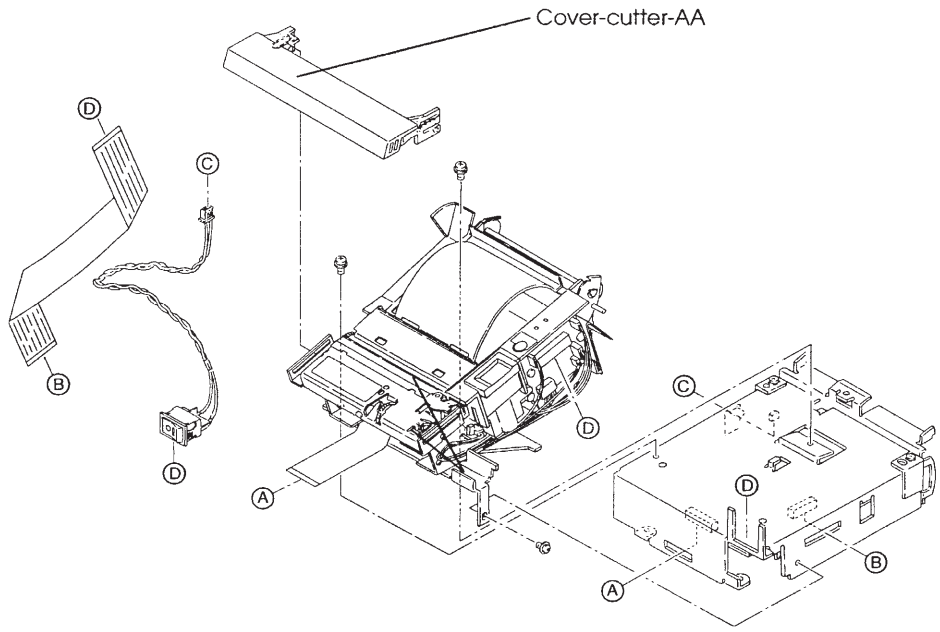
   CAUTION:
   During installation, make sure you do not pinch the {FFC-B} between the case and mechanism. Doing so can result in malfunction.
5. While removing the sticker, remove {switch panel -BA}.



To install, reverse the removal procedure.

Cover-cutter-AA

Detach the two dowels and remove {cover-cutter-AA}.



To install, reverse the removal procedure.

M-T88 printer mechanism block

1. Detach the two {FFC} and {FFC-B} connectors from {main circuit board unit-A}.
2. Slide off {power switch assembly-C} from [plate-circuit board block].

⚠ CAUTION:

During installation, take care to ensure that the switch is positioned correctly. The switch's OFF position should be facing O, while the ON position should be facing I.

3. Remove the three screws shown ①, ② and ③ in the illustration on page 5-7. Open the roll paper cover before you remove the ② and ③ screws.

Note:
<About the ② screw>
You will see three screw holes when you open the roll paper cover. Remove the screw from the middle hole.

4. Remove [M-T88 printer mechanism block] from [plate-circuit board block].

Note:
During installation, align the two [plate-circuit board block] dowels into the two holes on {plate-mechanism} which is mounted on [M-T88 printer mechanism block].

5. Remove {FFC-B} from [M-T88 printer mechanism block].

Note:
The {FFC-B} service part is not supplied pre-bent. When installing the {FFC-B} service part, make sure to bend it in the same shape as the {FFC-B} being replace.

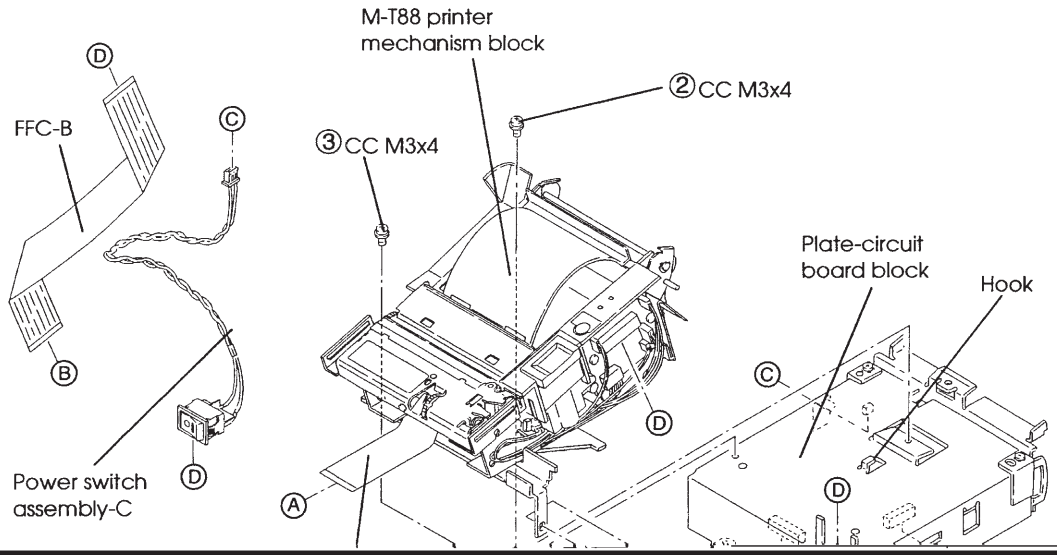
See page 5-9 for further disassembly and assembly of [M-T88 printer mechanism block].

6. Detach the {power switch assembly-C} connector from {main circuit board unit-A}.
7. Unhook the {power switch assembly-C} cable from [plate-circuit board block].

⚠ CAUTION:

There is a sharp edge on the hook. During installation of the cable onto the hook, make sure you do not damage the cable.

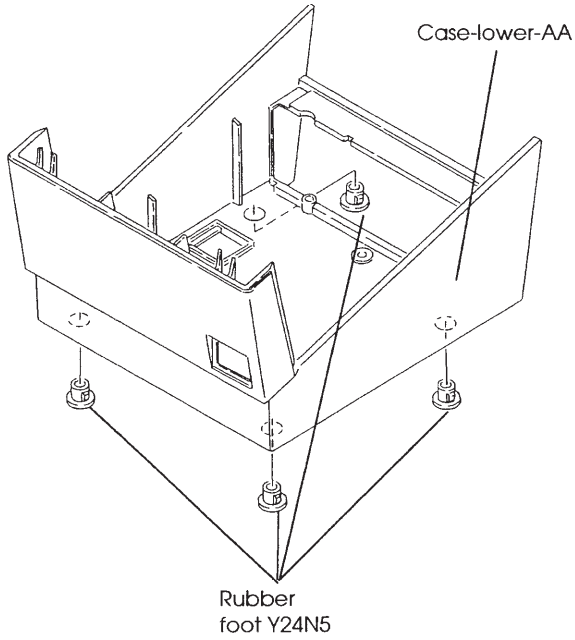
Note:
See page 5-10 for further disassembly and assembly of [plate-circuit board block].



Level 2 Disassembly and Assembly

Case-lower-AA block

Remove the four {rubber foot Y24N5} from {case-lower-AA} while pressing the two tabs on the {rubber foot Y24N5} to cause bending on the inside.

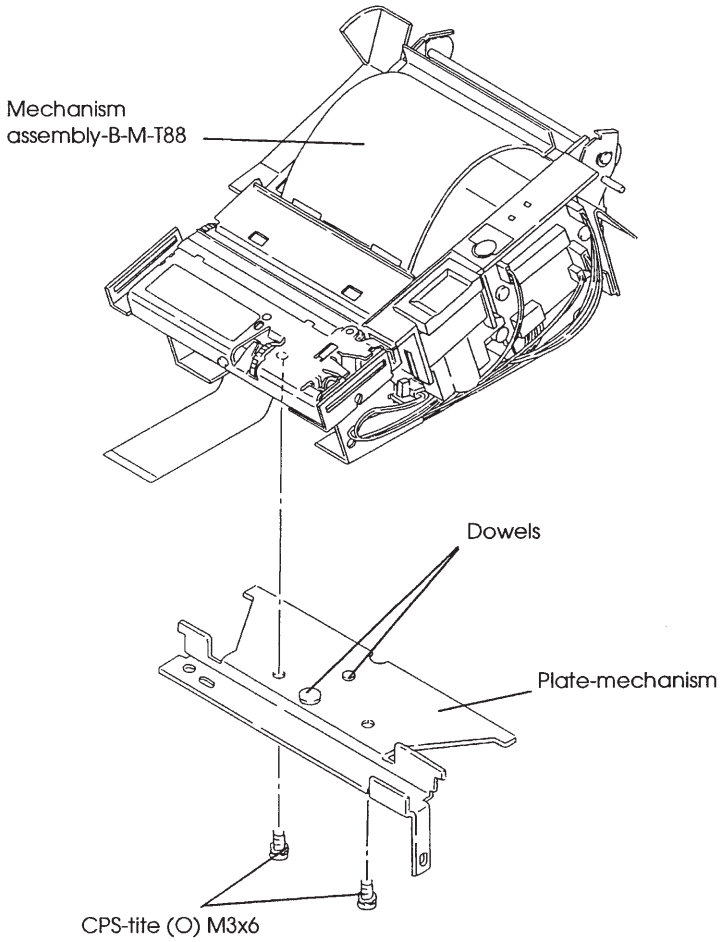


To install, reverse the removal procedure.

M-T88 printer mechanism block

Remove the two {CPS-tite (O) M3x6} screws; then remove {plate-mechanism} from {mechanism assembly-B-M-T88}.

Note:
During installation, align the two {plate-mechanism} dowels into the two {mechanism assembly-B-M-T88} holes; then secure the screws.



To install, reverse the removal procedure.

Note:
See page 5-14 for further disassembly and assembly of {mechanism assembly-B-M-T88}.

Plate-circuit board block

⚠ CAUTION:

When performing this procedure, be sure to use a grounded wrist band and take other measures to protect against electrostatic charge.

Internal circuit board components become hot during normal use. Make sure they have cooled sufficiently before performing this procedure.

After removing these circuit boards, be sure to protect them against electrostatic charge damage by placing them in an anti-static bag.

1. Remove the two {CPS-tite (O) M3x6} screws and remove [I/F circuit board assembly block].

   Note:
   See page 5-12 for further disassembly and assembly of [I/F circuit board assembly block].

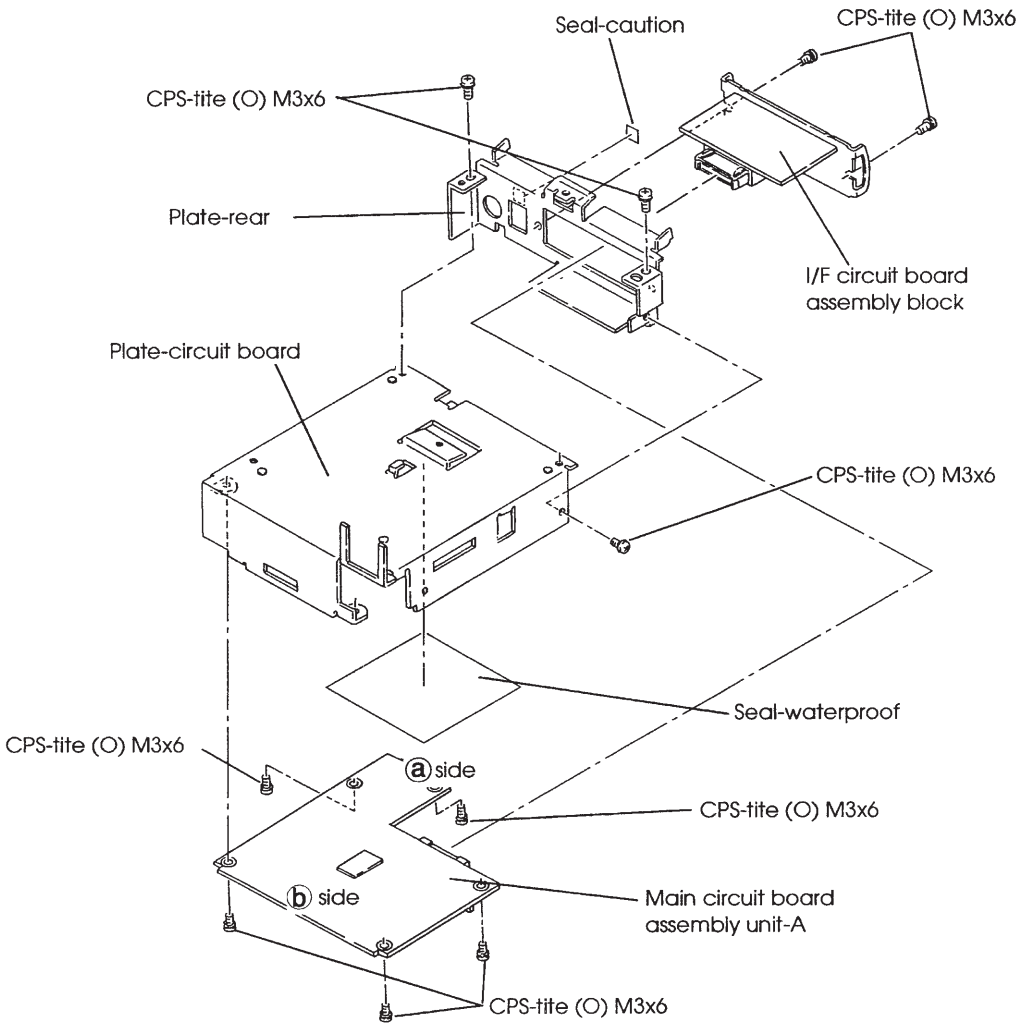
2. Remove the five {CPS-tite (O) M3x6} screws and remove {main circuit board unit-A}.

   To remove {main circuit board unit-A}, lift up from ⓐ side shown in the illustration on the next page; then remove it.

3. Remove three {CPS-tite (O) M3x6} screws and remove {plate-rear} from {plate-circuit board}.

   Note:
   During installation, align the two {plate-circuit board} dowels into the two {plate-rear} holes; then secure the screws.

4. While removing the sticker, remove {seal-caution} and {seal-waterproof}.



To install, perform the following procedure:

1. Affix {seal-caution} and {seal-waterproof} in the position shown in the illustration above.
2. While aligning the two dowels, install {plate-rear} and secure it with the three {CPS-tite (O) M3x6} onto {plate-circuit board}.
3. Install {main circuit board unit-A} on {plate-circuit board} from ⓑ side shown in the illustration. At this point, do not secure it with the screws.

⚠ CAUTION:

Do not secure {main circuit board unit-A} at this point. Doing so can cause a malfunction of the printer due to a connection failure between {main circuit board unit-A} and (I/F circuit board assembly block) connectors.

4. Install {I/F circuit board assembly block] and secure it with the two {CPS-tite (O) M3x6} screws.

5. While attaching the {main circuit board unit-A} connector to the [I/F circuit board assembly block] connector with no gap, secure {main circuit board unit-A} with the five {CPS-tite (O) M3x6} screws.

Level 3 Disassembly and Assembly

I/F circuit board assembly block

⚠ CAUTION:

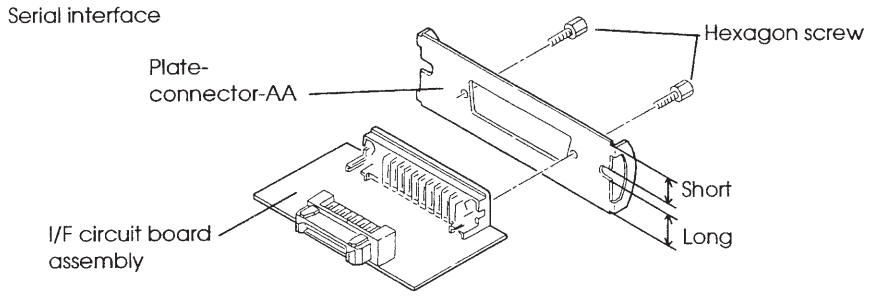
When performing this procedure, be sure to use a grounded wrist band and take other measures to protect against electrostatic charge.

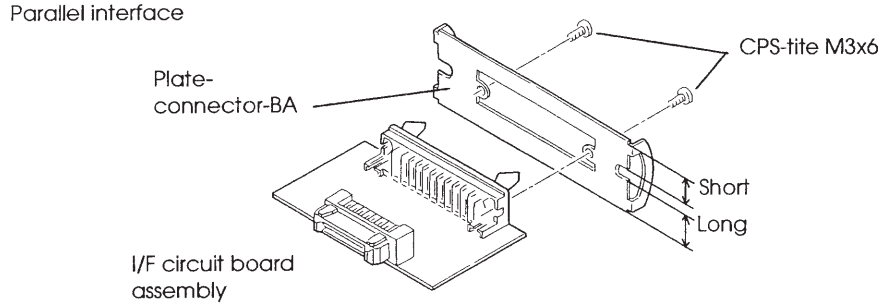
Circuit board components become hot during normal use. Make sure they are cooled sufficiently before performing this procedure.

After removing the circuit board, be sure to protect it against electrostatic charge damage by placing it in an anti-static bag.

1. Remove the two {hexagon screws} ({CPS-tite M3x6} in the case of the parallel interface).

2. Remove {plate-connector-AA} ({plate-connector-BA} in the case of the parallel interface) from {I/F circuit board assembly}.





Note:
Note that {plate-connector-AA} and {plate-connector-BA} must be oriented correctly when installed. See the illustrations for correct orientation.

To install, reverse the removal procedure.

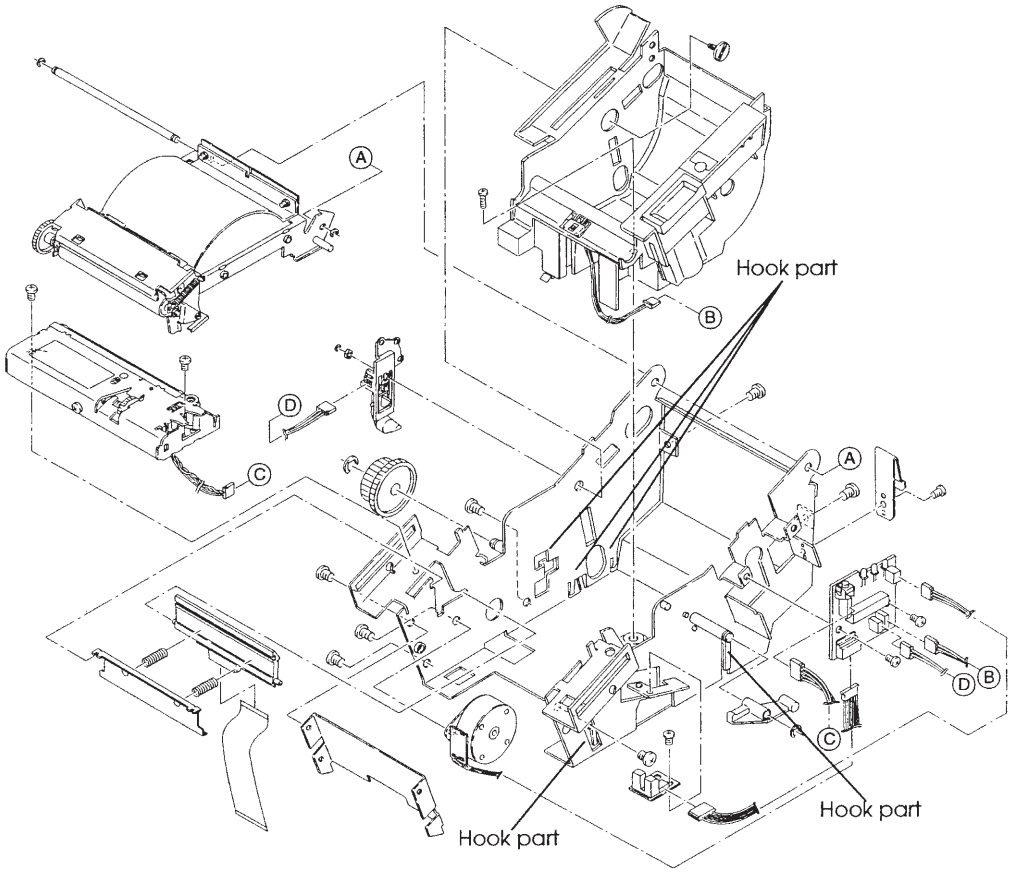
M-T88 Printer Mechanism Disassembly and Assembly

Note:
No adjustments are required for the M-T88 printer mechanism.

Level 1 Disassembly and Assembly

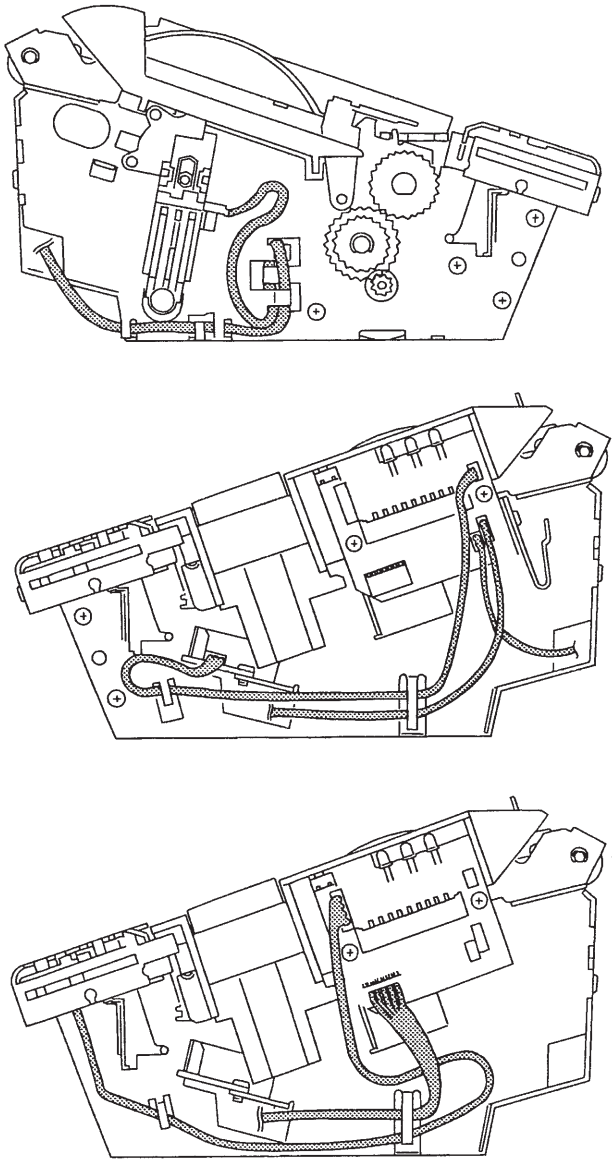
Cable Routing

1. Open up the two hooks on the right side of the printer 1 mm or 2 mm and remove the cables.
2. Unhook the cables on the left side of the printer.



Use the following procedure to install the cables:

1. Install the cables onto the hooks of {frame assembly} as shown in the illustrations.



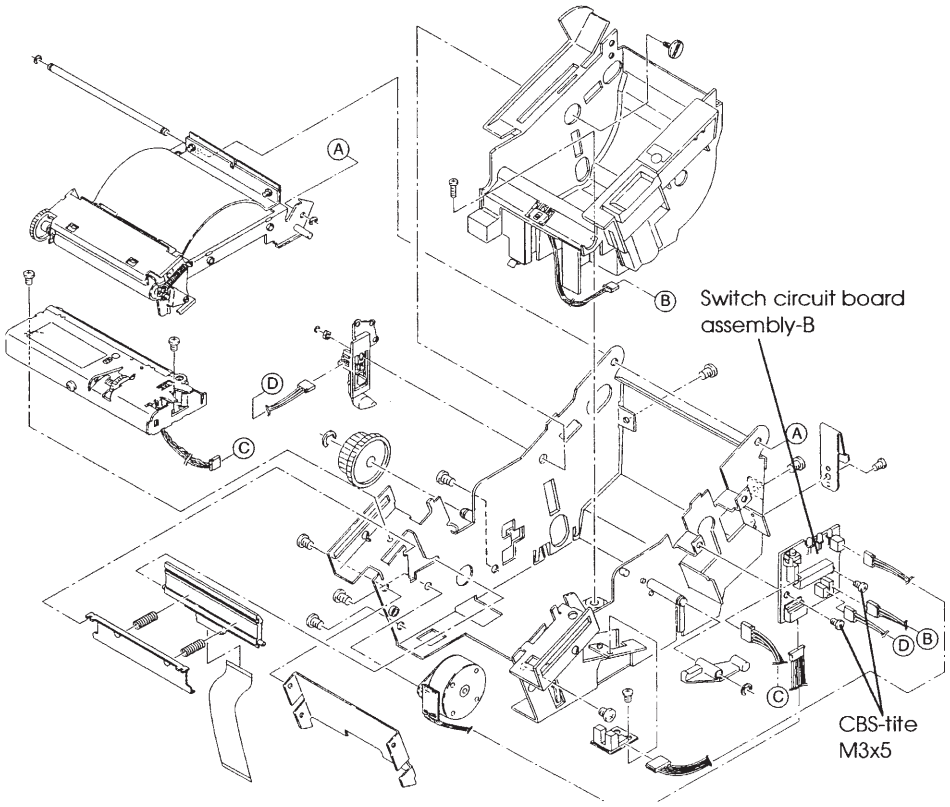
2. Bend the tips of the two hooks on the right side of {frame assembly} 1 mm or 2 mm to secure the cables in place.

⚠ CAUTION:

Do not bend the two hooks on the right side of {frame assembly} more than 2 mm. Doing so can cut the cable and cause a short circuit, which will result in malfunction of the printer.

Switch circuit board assembly-B

1. Remove the five cable connectors from {switch circuit board assembly-B}.
2. Remove the two {CBS-tite M3x5} screws and then {switch circuit board assembly-B}.

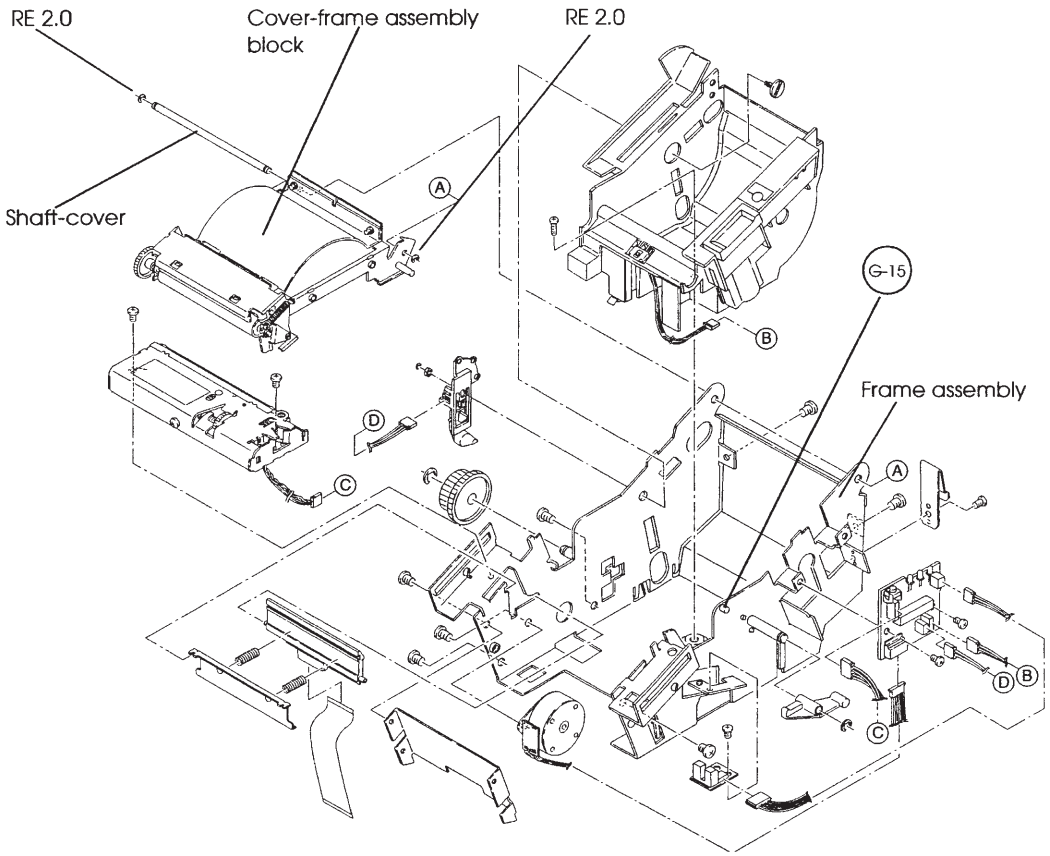


To install, reverse the removal procedure.

Cover-frame assembly block

1. Remove the two {RE 2.0} retaining rings and then {shaft-cover}.
2. Remove [cover-frame assembly block].

Note:
See page 5-29 for further disassembly and assembly of [cover-frame assembly block].



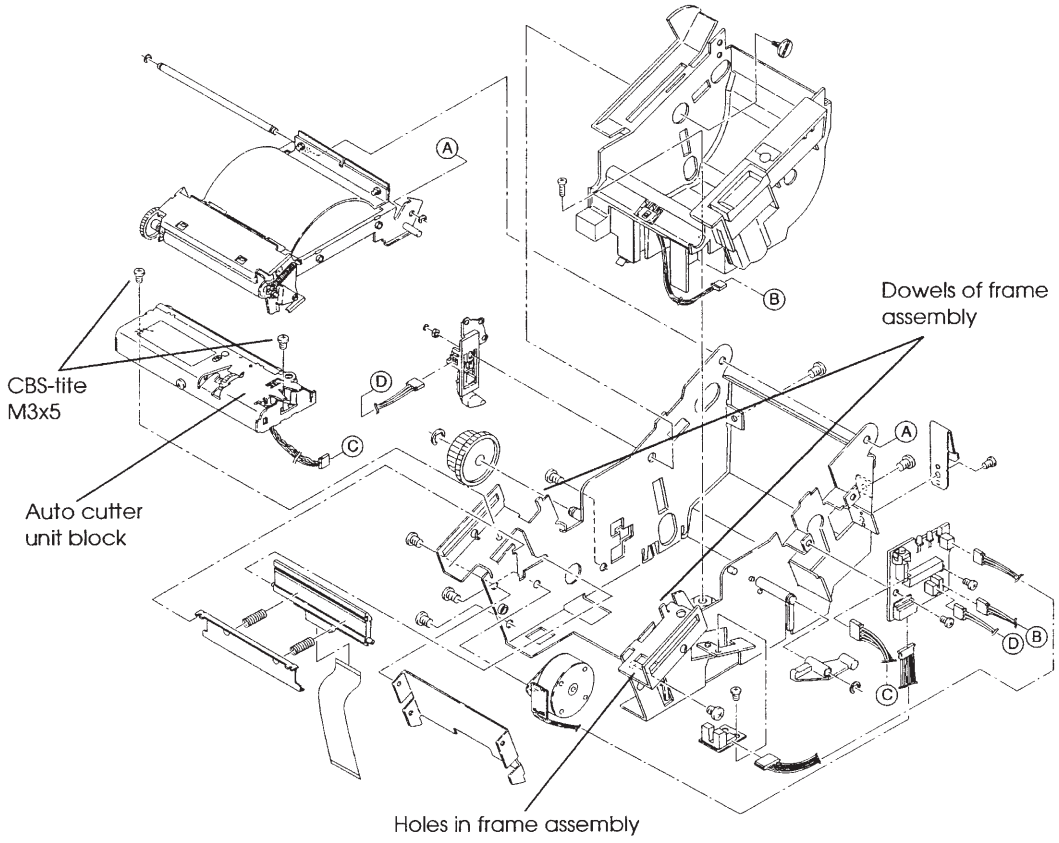
The following is the installation procedure:

1. Lubricate {frame assembly} shaft with G-15.
2. Install [cover-frame assembly block].
3. Install {shaft-cover} and secure it with two {RE2.0} retaining rings.

Auto cutter unit block

Remove the two {CBS-tite M3x5} screws and then [auto cutter unit block].

Note:
See page 5-31 for further disassembly and assembly of [auto cutter unit block].



The following is the installation procedure:

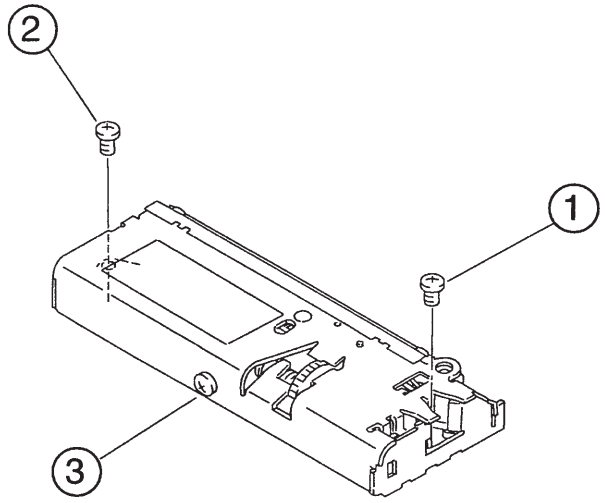
1. Run the [auto cutter unit block] cables through the holes in {frame assembly}.
2. Install [auto cutter unit block].

   Make sure that the two dowels of {frame assembly} align with the two cutouts of [auto cutter unit block] when installing [auto cutter unit block].
3. Secure [auto cutter unit block] in place with two {CBS-tite M3x5} screws.
4. Following the steps below, secure [auto cutter unit block] in place with two {CBS-tite M3x5} screws.

⚠ CAUTION:

You must follow the steps described below. If you do not follow them it could cause an auto cutter operation failure.

1. Secure the right side screw.
2. Secure the left side screw.
3. Loosen the screw securing {cover-paper cutter assembly} once; then secure it again.



Note:
While securing these screws, do not deform {frame assembly}. This can damage the cutter.

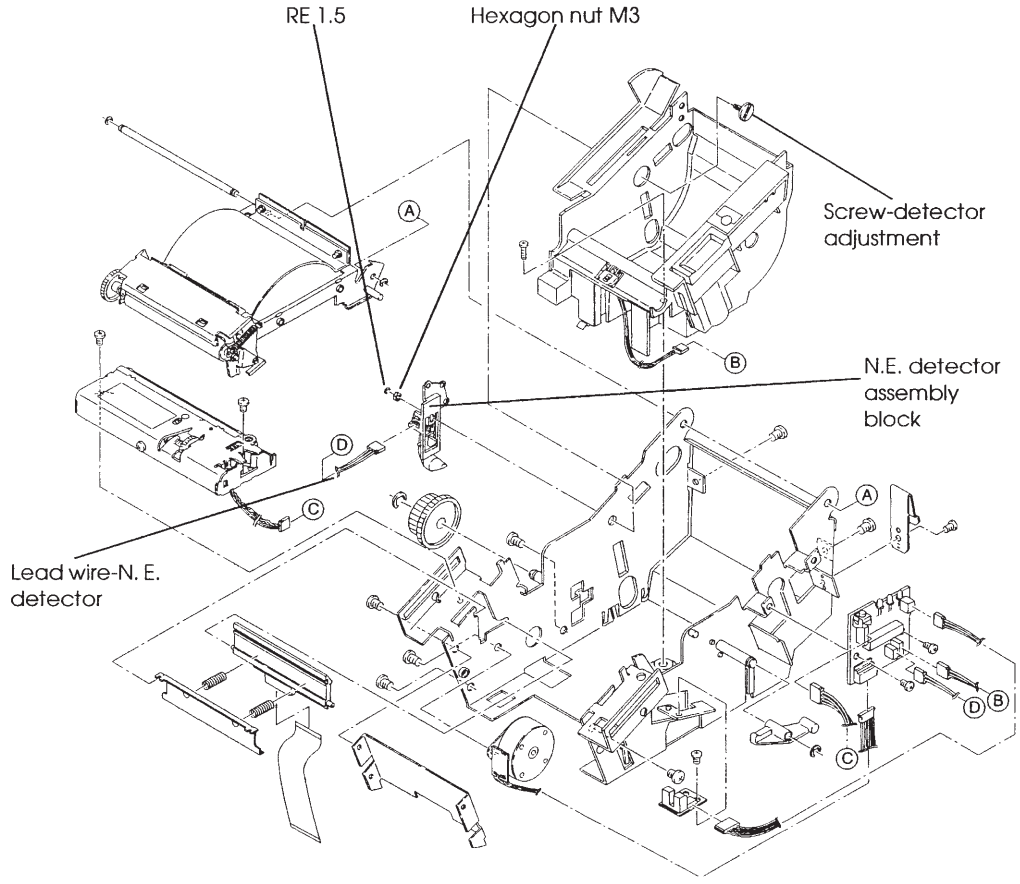
N.E. detector assembly block

1. Detach the {lead wire-N.E. detector} from [N.E. detector assembly block].
2. Remove the single {RE 1.5} retaining ring.
3. Remove {screw-detector adjustment} and {hexagon nut M3}.

   To remove these parts, rotate {screw-detector adjustment} counterclockwise.

Note:
Use a flat-blade screwdriver or coin to rotate {screw-detector adjustment}.

See page 5-33 for further disassembly and assembly of [N.E. detector assembly block].

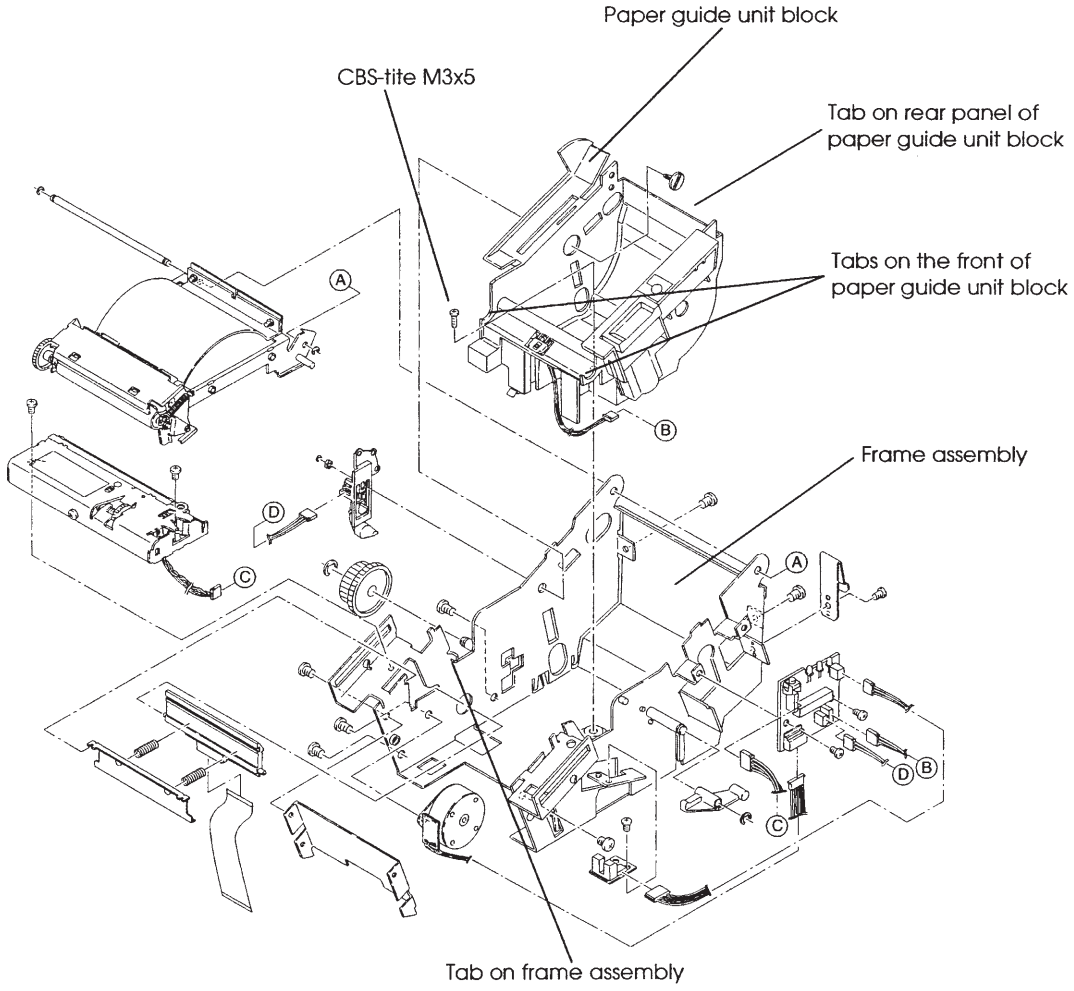


To install, reverse the removal procedure.

Paper guide unit block

1. Remove the single {CBS-tite M3x5} screw.
2. Detach the tabs on the back of [paper guide unit block] from {frame assembly}.
3. Remove [paper guide unit block].

Note:
See page 5-35 for further disassembly and assembly of [paper guide unit block].



The following is the installation procedure:

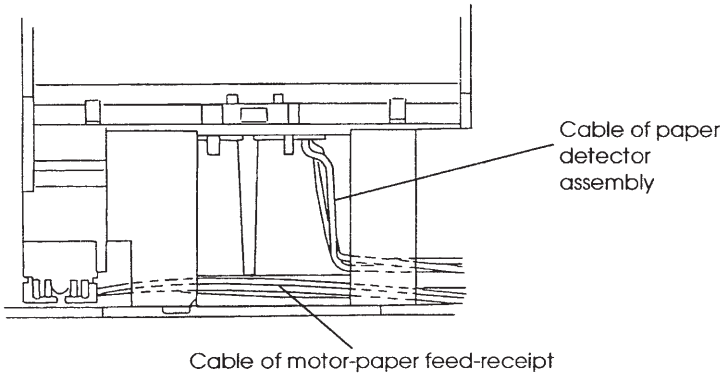
1. Position the two tabs on the front of [paper guide unit block] so they are below the two {frame assembly} tabs.

2. Install [paper guide unit block] on {frame assembly}.

   When installing [paper guide unit block], make sure that the {motor-paper feed-receipt} and {paper detector assembly} cables are positioned as shown in the illustration below.

   ## ⚠ CAUTION:

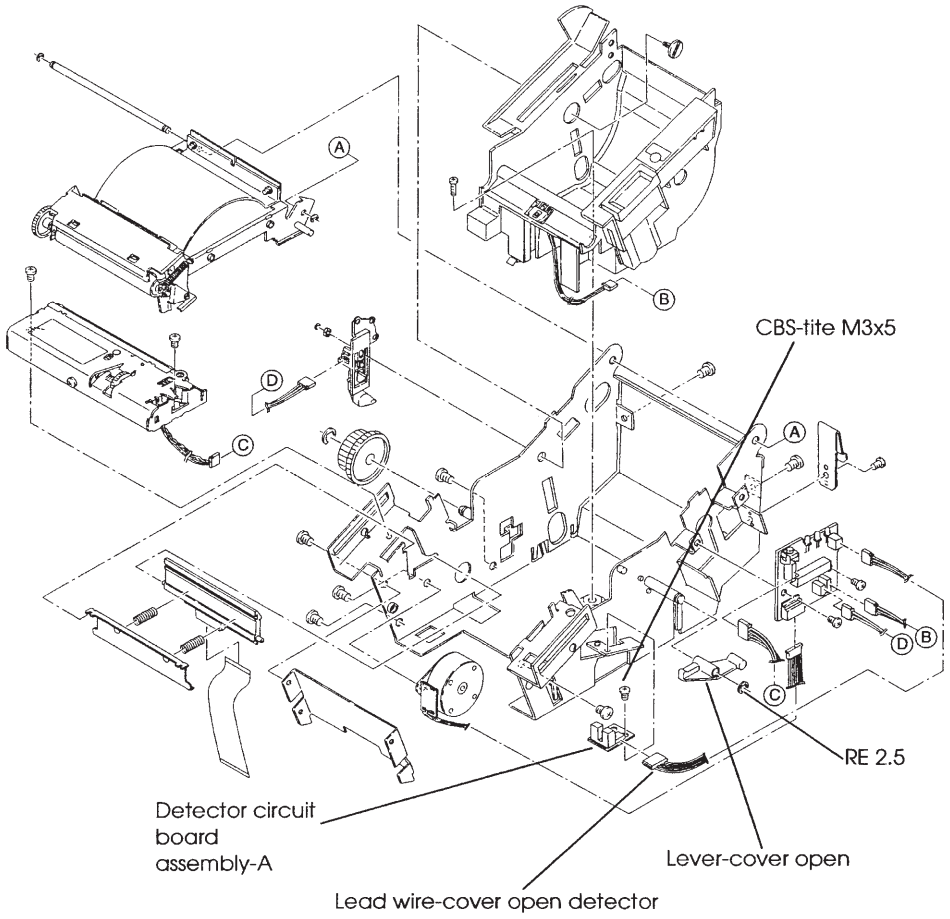
   Make sure that cables are not pinched between {paper guide unit block} and {frame assembly}. Doing so can cut the cable and cause a short circuit, which will result in malfunction of the printer.



3. Secure [paper guide unit block] in place with the single {CBS-tite M3x5} screw.

Detector circuit board assembly-A

1. Remove the single {RE 2.5} retaining ring and then {lever-cover open}.
2. Disconnect the {lead wire-cover open detector} connector from {detector circuit board assembly-A}.
3. Remove the single {CBS-tite M3x5} screw and then {detector circuit board assembly-A}.



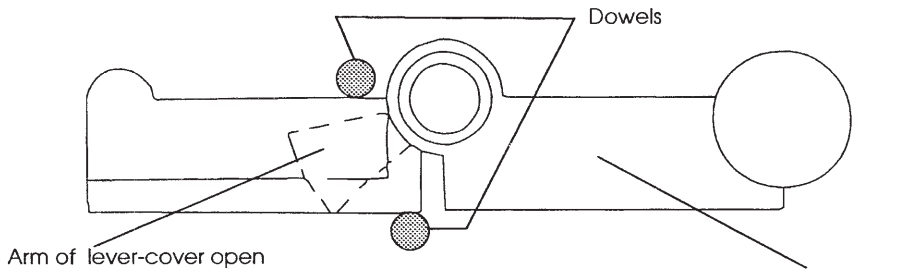
The following is the installation procedure:

1. Aligning the single dowel, install {detector circuit board assembly-A} and secure it in place with the single {CBS-tite M3x5} screw.

2. Connect the {lead wire-cover open detector} connector to {detector circuit board assembly-A}

3. Install {lever-cover open} on {frame assembly}.

   At this time, align the arm of {lever-cover open} between the two dowels on {frame assembly} as shown in the illustration.



Side view of lever-cover open

4. Secure {lever-cover open} with the single {RE 2.5} retaining ring.

Thermal head

⚠ CAUTION:

Note that {thermal head} becomes very hot during normal operation, creating the danger of burn injury. Be sure to wait for about 10 minutes after turning printer power off before beginning the following procedure.

When performing this procedure, be sure to use a grounded wrist band or take other measures to protect against electrostatic charge. Failure to do so can result in damage to {thermal head}.

Never touch the thermal element (the area that looks like it is marked with a thin black line) of {thermal head} with your hand. Doing so can damage the heating element.

Whenever there is dirt or any other foreign matter on {thermal head}, clean it off with a cotton swab moistened with alcohol.

1. Remove the three {CBS-tite M3x5} screws and then {strengthen plate-frame}.

2. Press {plate-spring press} toward [paper guide unit block] and then detach {plate-spring press} from the two {frame assembly} tabs.

3. While holding the two {spring-press head} so they do not fly out, remove {plate-spring press}.

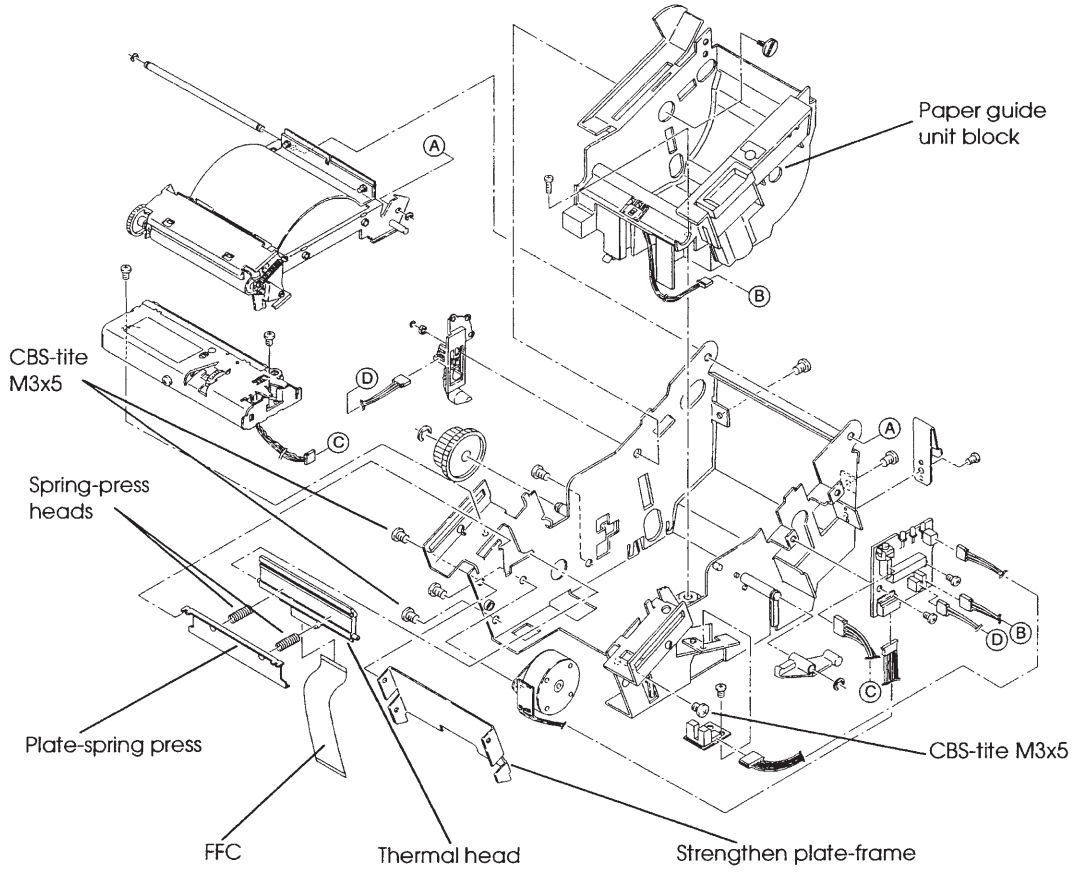
⚠ CAUTION:

Be sure to hold the two {spring-press heads} while removing {plate-spring press}. Otherwise, {spring-press heads} may suddenly fly out, creating the danger of eye injury.

4. Detach {spring-press heads} from {plate-spring press}.
5. Remove {thermal head}.
6. Disconnect {FFC} from {thermal head}.

⚠ CAUTION:

After removing {thermal head}, be sure to protect it against electrostatic charge damage by placing it in an anti-static bag.



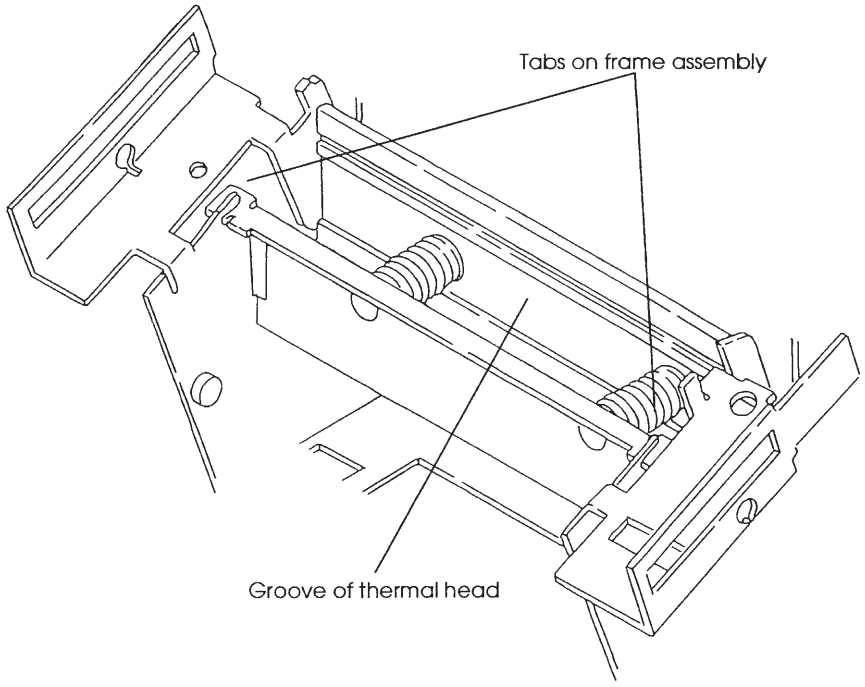
The following is the installation procedure:

1. Attach {FFC} to {thermal head} so that the surface of {FFC} with text printed on it is facing the {plate-spring press}.
2. Place {thermal head} in its installation position inside the printer.
3. Insert the two {spring-press heads} onto the two {plate-spring press} dowels.
4. Place {plate-spring press} in its installation position.
5. Insert the two {spring-press heads} into the groove of {thermal head}.
6. While holding the two {spring-press heads} so they do not fly out, install {plate-spring press}.

⚠ CAUTION:

Be sure to hold the two {spring-press heads} while installing {plate-spring press}. Otherwise, {spring-press head} may suddenly fly out, creating the danger of eye injury.

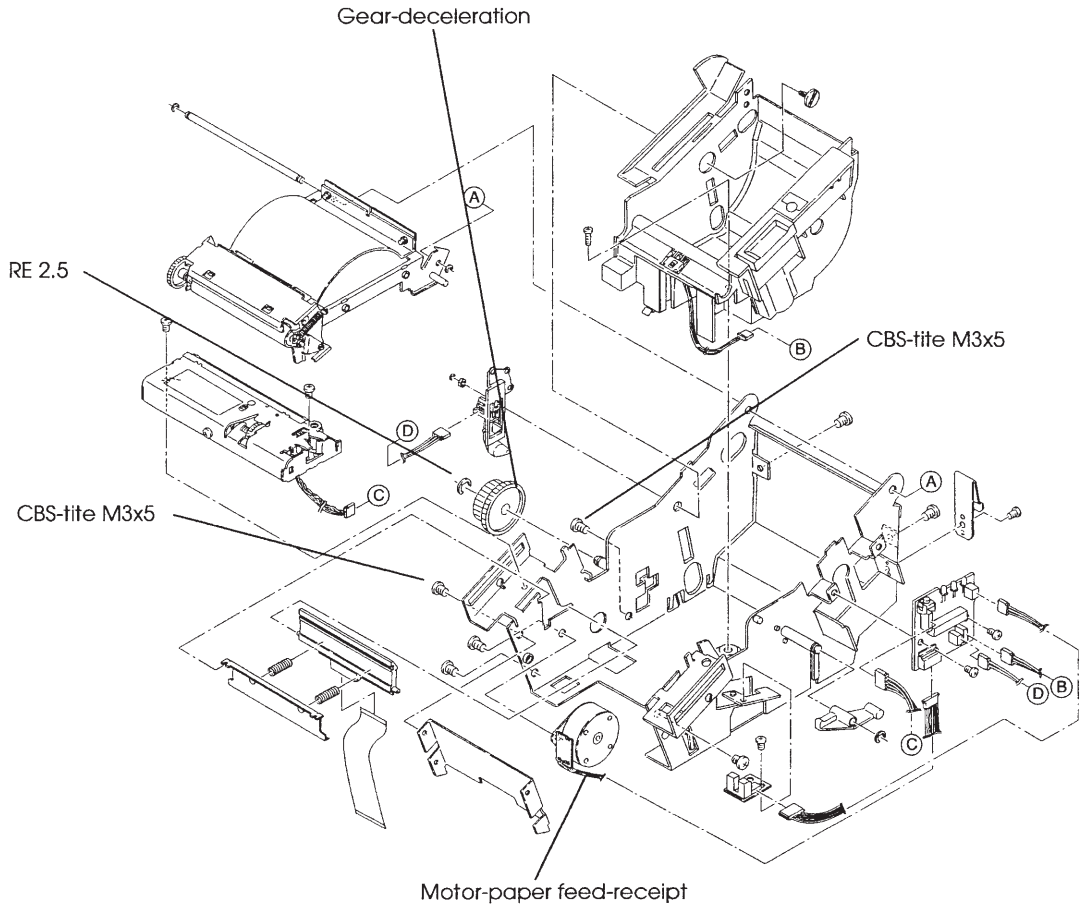
When installing {plate-spring press}, align it with the two cutting places on {frame assembly} as shown in the illustration below.



7. Adjust the two {spring-press heads} so they are perpendicular with {thermal head}.
8. Install {strengthen plate-frame} and secure it with the three {CBS-tite M3x5} screws.

Motor-paper feed-receipt

1. Remove the single {RE 2.5} retaining ring, and then {gear-deceleration}.
2. Remove the two {CBS-tite M3x5} screws and then {motor-paper feed-receipt}.



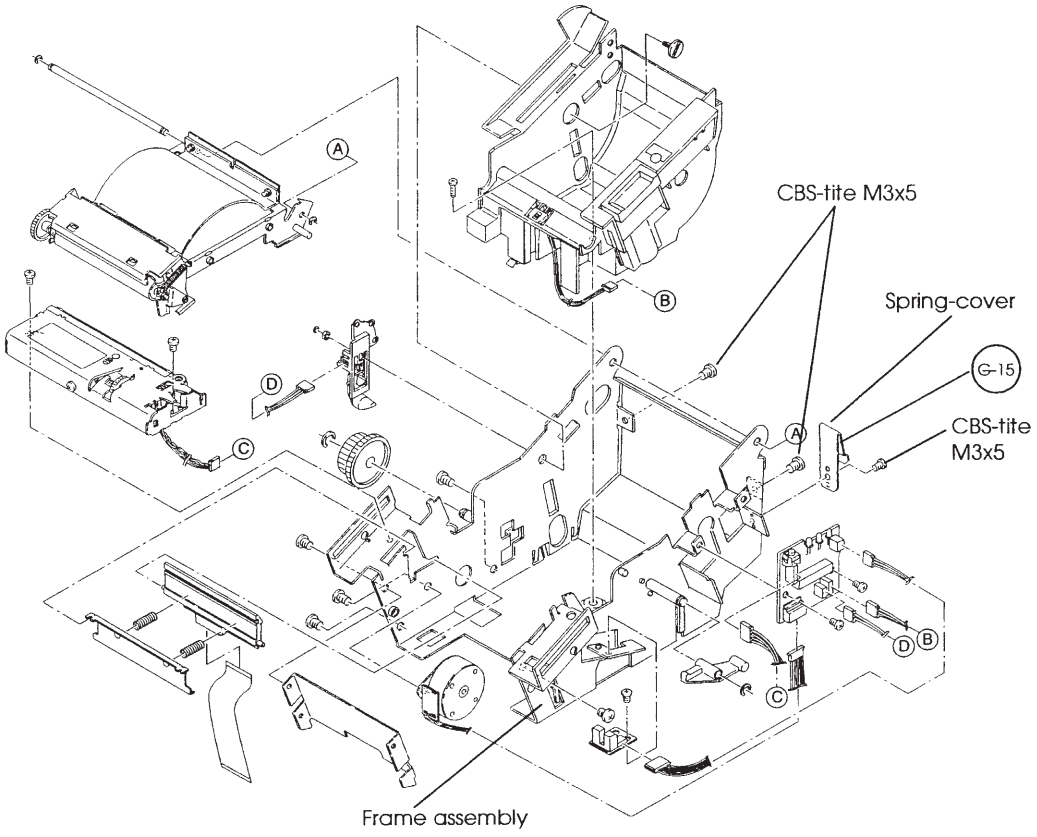
The following is the installation procedure:

1. Aligning the single dowel, install {motor-paper feed-receipt} and secure it with the two {CBS-tite M3x5} screws.
2. Install {gear-deceleration} and secure it with the single {RE 2.5} retaining ring.

Note:
Note that {gear-deceleration} must be oriented correctly when installed. See the illustration above for correct orientation.

Frame assembly

1. Remove the single {CBS-tite M3x5} screw and then {spring-cover}.
2. Remove the two {CBS-tite M3x5} screws from {frame assembly}.



To following is the installation procedure:

1. Secure the two {CBS-tite M3x5} on {frame assembly}.
2. Install {spring-cover} and secure it with the single {CBS-tite M3x5} screw.
3. Lubricate {spring-cover} with G-15. Apply G-15 on the surface where the [cover-frame assembly block] shaft contacts it.

Level 2 Disassembly and Assembly

Cover-frame assembly block

1. Remove {spring-shutter}.
2. Remove the four {CBS-tite M3x5} and then {cover-roll paper}.
3. While peeling off the back seal, remove {label-handling-BA}.
4. While opening {shutter blade assembly}, detach the two tabs and then remove {fixed blade}.

⚠ CAUTION:

Be careful because {fixed blade} is equipped with a sharp blade. Handle it with care.

Note:
Note that {fixed blade} must be oriented correctly when installed.

During installation, insert {fixed blade} under the two {spring-fixed blade holders}.

5. Remove the two {spring-fixed blade holders} by detaching the tabs and then sliding the holders off.

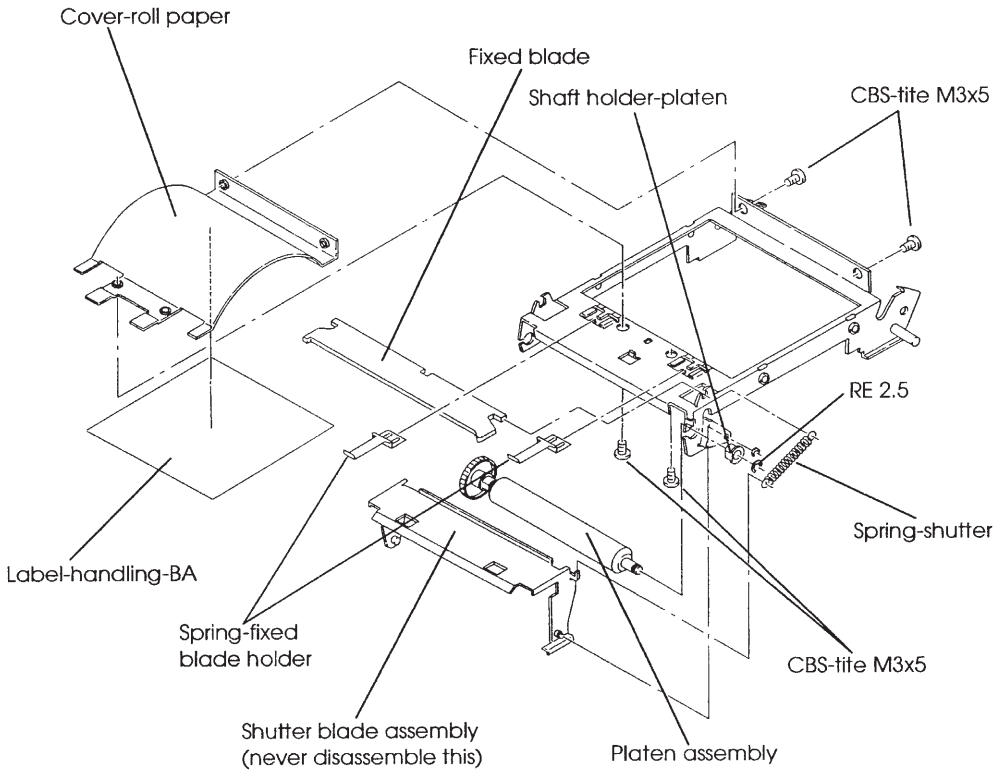
Note:
Take care not to bend or twist the two {spring-fixed blade holders}.

During installation, make sure the two {spring-fixed blade holders} are securely locked in place by the tabs.

6. Remove the single {RE 2.5} retaining ring, and then remove {platen assembly} and {shaft holder-platen}.

Note:
Note that {shaft holder, platen} must be oriented correctly when installed. See the illustration below for correct orientation.

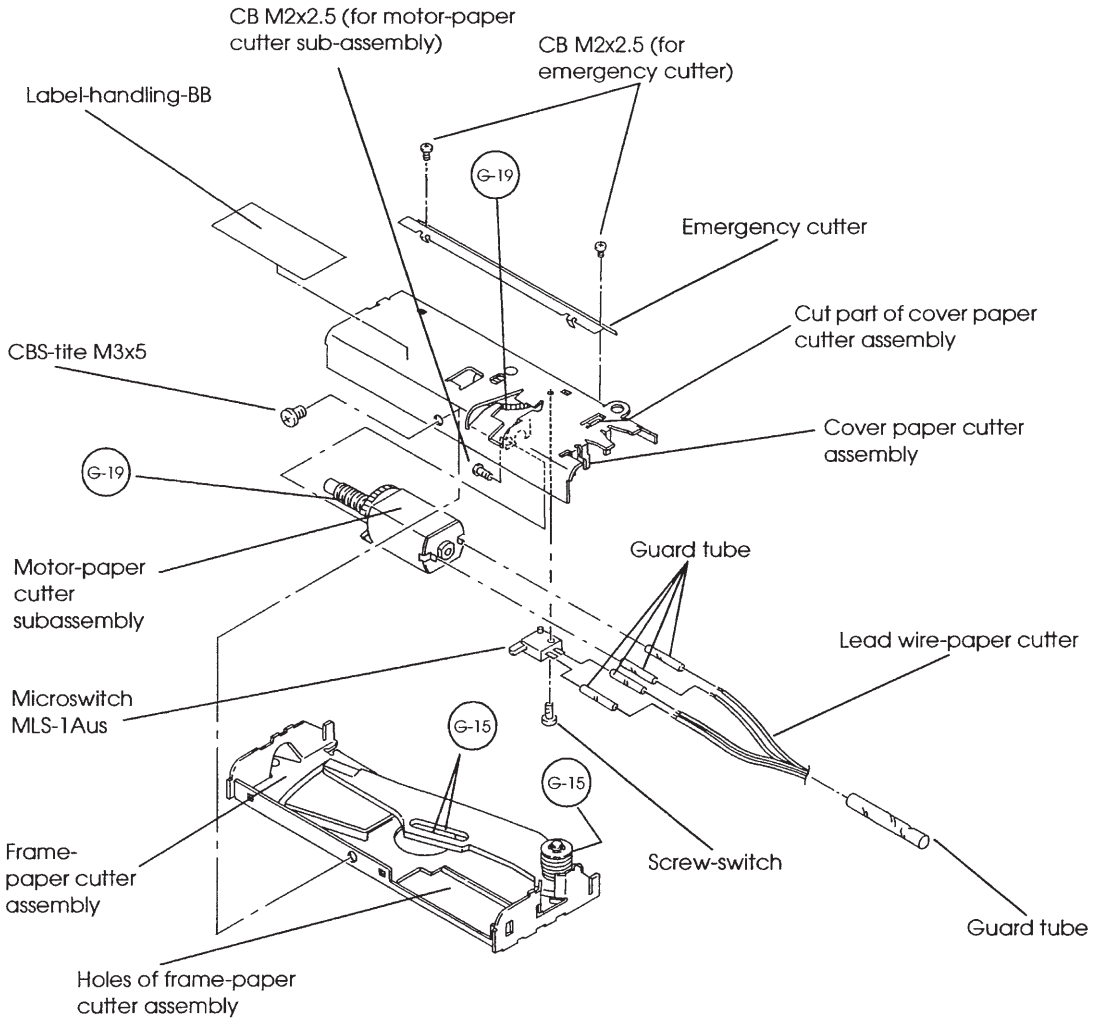
Note:
Note that you cannot remove {shutter blade assembly} although the illustration below shows that it is removed.



To install, reverse the removal procedure.

Auto cutter unit block

1. Remove the two {CB M2x2.5} screws and then {emergency cutter}.
2. While peeling the back seal, remove {label-handling-BB}.
3. Remove the single {CBS-tite M3x5} screw and then {cover-paper cutter assembly}.
4. Remove the single {CB M2x2.5} screw and then {motor-paper cutter sub-assembly}.
5. Remove {screw-switch} and then {microswitch MLS-1Aus}.
6. Remove the four {shield tube} from {lead wire-paper cutter}.
7. Use a soldering iron to detach {lead wire-paper cutter} from {motor-paper cutter sub-assembly} and {microswitch MLS-1Aus}.
8. Remove {guard tube} from {lead wire-paper cutter}.



The following is the installation procedure:

1. Pass {guard tube} through {lead wire-paper cutter}.
2. Pass the four {shield tubes} through the four wires of {lead wire-paper cutter} individually.
3. Solder {lead wire-paper cutter} to {motor-paper cutter sub-assembly} and {microswitch MLS-1Aus} in accordance with the following table.

Terminal	{Lead wire-paper cutter} Lead wire color
Motor (+) Terminal	Red
Motor (-) Terminal	Black
Microswitch Terminal	White
Microswitch Terminal	White

4. Move the four {shield tubes} to the soldered connection and use a dryer to shrink them.
5. Install {microswitch MLS-1Aus} on {cover-paper cutter assembly} and secure it with {screw-switch}.

⚠ CAUTION:

Tighten this screw with the specified torque of 0.176 N·m {1.8 Kg·cm}. Overtightening this screw can deform {microswitch MLS-1Aus} and result in printer malfunction.

6. Hook the {microswitch MLS-1Aus} lead wire in the cut of {cover-paper cutter assembly}.
7. Install {motor-paper cutter sub-assembly} on {cover-paper cutter assembly} and secure it with the single {CB M2x2.5} screw.

⚠ CAUTION:

Tighten this screw with the specified torque of 0.245 N·m {2.5 Kg·cm}. Overtightening this screw can damage the screw and the parts around the screw.

8. Pass {lead wire-paper cutter} through the hole of {frame-paper cutter assembly}.
9. Move the {guard tube} on {lead wire-paper cutter} towards {motor-paper cutter sub-assembly} as far as it will go.
10. Lubricate the {motor-paper cutter sub-assembly} gear with G-19.
11. Lubricate three locations of {frame-paper cutter assembly} with G-15.
12. Lubricate the {gear-drive} gear on {cover-paper cutter assembly} with G-19. See the illustration in step 13 of this procedure for the location of the {gear-drive}.

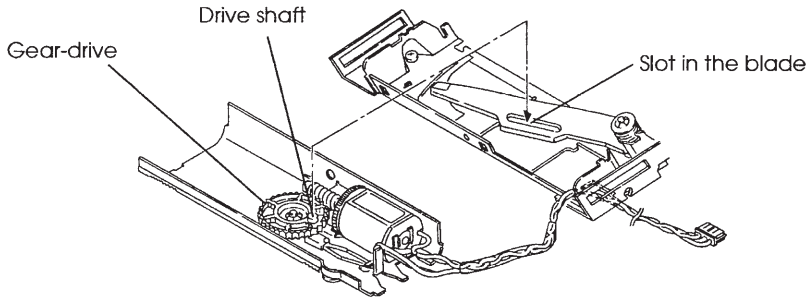
✎ ***Note:***
The {gear-drive} is an unremovable part.

13. Install {cover-paper cutter assembly} on {frame-paper cutter assembly}.

⚠ CAUTION:

Make sure that {lead wire-paper cutter} is not pinched between {cover-paper cutter assembly} and {frame-paper cutter assembly}.

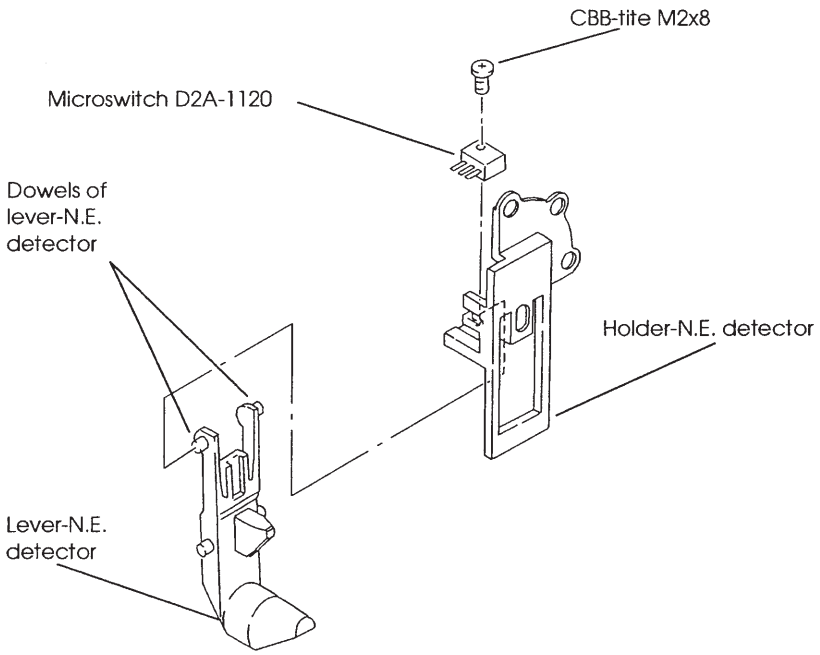
Install {cover-paper cutter assembly} while aligning the drive shaft on {cover-paper cutter assembly} into the slot on the blade of {frame-paper cutter assembly}. See the illustration below.



14. Secure {cover-paper cutter assembly} with the single {CBS-tite M3x5} screw.
15. Affix {label-handling-BB} onto {frame-paper cutter assembly}.
16. Install {emergency cutter} on {cover-paper cutter assembly} and secure it with the two {CB M2x2.5} screws.

N.E. detector assembly block

1. Remove the single {CBB-tite M2x8} screw and then {microswitch D2A-1120}.
2. Detach the two dowels and then remove {lever-N.E. detector}.



The following is the installation procedure:

1. Install {lever-N.E. detector} on {holder-N.E. detector}.

   ⚠ CAUTION:

   The two {lever-N.E. detector} dowels break easily. Take care when performing the above step.

   After installation, check for smooth operation of {lever-N.E. detector}. If operation is not smooth, remove {lever-N.E. detector} and re-install it.

2. Align the single dowel and install {microswitch D2A-1120} on {holder-N.E. detector}.

3. Secure {microswitch D2A-1120} in place with the single {CBB-tite M2x8} screw.

   ⚠ CAUTION:

   Tighten this screw with the specified torque of 0.176 N·m {1.8 Kg·cm}. Overtightening this screw can deform {microswitch D2A-1120} and result in printer malfunction.

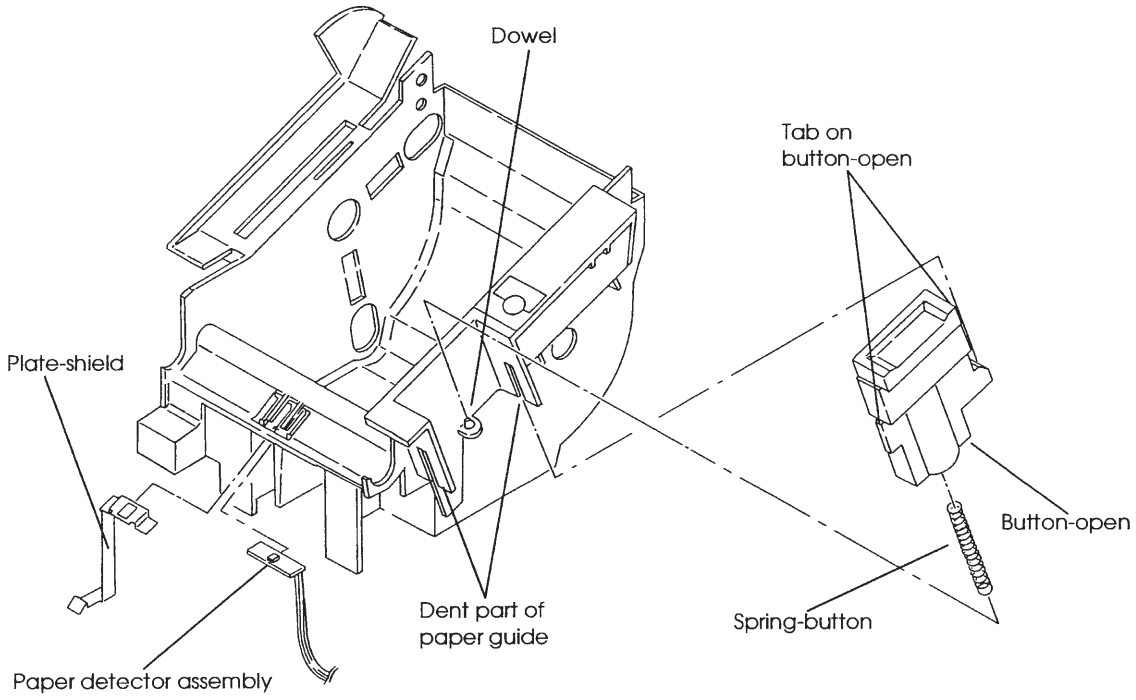
Paper guide unit block

1. Slide off {plate-shield}.
2. Detach the two tabs and remove {paper detector assembly}.
3. Remove {button-open} and {spring-button}.

⚠ CAUTION:

Be sure to hold {spring-button} while removing {button-open}. Otherwise, {spring-button} may suddenly fly out, creating the danger of eye injury.

To remove {button-open}, keep it depressed while you remove the protruding part of {button-open} from the groove in {paper guide}.



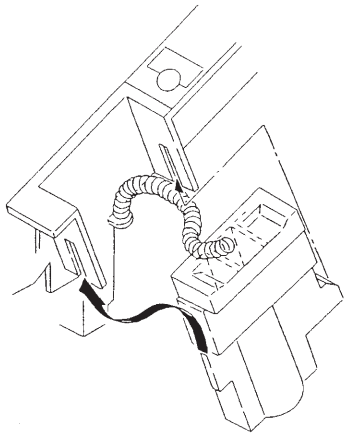
The following is the installation procedure:

1. Place {spring-button} on the {paper guide} dowel.
2. Align the top of {spring-button} with the inside of {button-open}.

⚠ CAUTION:

Be sure to hold {spring-button} during this procedure. Otherwise, {spring-button} may suddenly fly out, creating the danger of eye injury.

3. Insert the protruding part of {button-open} into the groove in {paper guide}. See the illustration below.



4. Check to make sure that the force of {spring-button} moves {button-open} to its original position when you remove your hand from {button-open}. Press {button-open} two or three times to check for correct operation.
5. Install {paper detector assembly} in its position. Make sure it is secured with the two dowels.
6. Slide {plate-shield} into place.

Appendix

IEEE 1284 Parallel Interface

(Bidirectional parallel interface: in accordance with the IEEE 1284 nibble/byte modes)

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Compatibility mode

(Data transmission from host to printer: Centronics compatible)

Data transmission:	8-bit parallel
Synchronization:	Externally supplied nStrobe signals
Handshaking:	nAck and Busy signals
Signal levels:	TTL compatible
Connector:	ADS-B36BLFDR176 (Honda Tsushin Kogyo Co., Ltd) or equivalent (IEEE 1284 Type B)

Switching between on-line and off-line

The printer is not equipped with any on-line/off-line switch. The printer goes off-line under any of the following conditions:

- When the power is turned on or until the printer becomes ready for data transmission after it is initialized by the reset signal (ninit) from the interface.
- During the self-test.
- While the cover is open.
- While paper is fed using the paper feed button.
- When the printer stops printing due to a paper-end (in cases when an empty paper supply is detected by either the paper roll end detector or the paper roll near-end detector with a printing halt due to paper shortage enabled by ESC c 4).
- During macro executing standby status.
- When an error has occured.

Reverse mode

(Data transmission from printer to host)

The STATUS data transmission from the printer to the host is accomplished in the Nibble or Byte mode.

This mode allows data transmission from the asynchronous printer under the control of the host. Data transmissions in the Nibble mode are made via the existing control lines in units of four bits (Nibble). In the Byte mode, data transmission is accomplished by making the 8-bits data lines bidirectional.

Neither mode can operate at the same time as the compatibility mode, so switching is always required.

Printer status and signals

Pin No.	Source	Compatibility mode	Nibble mode	Byte mode
1	Host	nStrobe	HostClk	HostClk
2	Host/Printer	Data0 (LSB)	Data0 (LSB)	Data0 (LSB)
3	Host/Printer	Data1	Data1	Data1
4	Host/Printer	Data2	Data2	Data2
5	Host/Printer	Data3	Data3	Data3
6	Host/Printer	Data4	Data4	Data4
7	Host/Printer	Data5	Data5	Data5
8	Host/Printer	Data6	Data6	Data6
9	Host/Printer	Data7 (MSB)	Data7 (MSB)	Data7 (MSB)
10	Printer	nAck	PtrClk	PtrClk
11	Printer	Busy	PtrBusy/Data3, 7	PtrBusy
12	Printer	PError	AckDataReq/ Data2, 6	AckDataReq
13	Printer	Select	Xflag/Data1, 5	Xflag
14	Host	nAutoFd	HostBusy	HostBusy
15		NC	ND	ND
16		GND	GND	GND
17		FG	FG	FG
18	Printer	Logic-H	Logic-H	Logic-H
19 to 30		GND	GND	GND
31	Host	nInit	nInit	nInit
32	Printer	nFault	nDataAvail/Data0, 4	nDataAvail
33		GND	ND	ND
34	Printer	DK_STATUS	ND	ND
35	Printer	+5V	ND	ND
36	Host	nSelectIn	1284-Active	1284-Active

NC: Not connected, ND: Not defined

Notes:

- *A prefix "n" to signal names refers to low active signals.*
- *If the host does not have any one of the signal lines listed above, two-way communication fails.*
- *For interfacing, signal lines should use twisted pair cables with the return sides connected to the signal ground level.*
- *Interfacing conditions should be all based on the TTL level. In addition, both the rise time and fall time of each signal must be 0.5 µs or less.*

- *Data transmission should not ignore the signal nAck or Busy. An attempt to transmit data with either signal, nAck or Busy, ignored can cause lost data. (Data transmission to the printer should be made after verifying the nAck signal or while the Busy signal is low.)*

- *Interface cables should be as short as possible.*

Precautions on receiving status from the printer

The printer status transmission is available by using the both-way communication facility in the Nibble/Byte mode in accordance with the IEEE 1284 mode.

The following precautions must be taken for receiving the status from the printer.

- The allowable capacity of the printer's internal buffer is 100 bytes. Status signals exceeding this capacity will be discarded. To prevent possible loss of status data, the host should always be ready for data reception (reverse mode).

- When ASB is used, the host should be in the wait state for data reception (reverse idle mode). When this state is not available, the host should enter the reverse mode to always monitor the presence of data.

- When ASB is used, preference should be given to the ASB status for transmission over the other status signals. Any accumulated ASB status signals left for transmission from the last to the newest ASB status transmission should be transmitted together at one time as one ASB status showing the change has been made, followed by the latest ASB status.

Example: In the normal (wait) state, the ASB status is configured as follows:

1st status	2nd status	3rd status	4th status
0000 1000	0000 0000	0000 0000	0000 0000

When the following sequence of operations is performed, near end detection, cover open, cover closed, the following pieces of data are accumulated.

	1st status	2nd status	3rd status	4th status	
1	0000 1000	0000 0000	0000 0011	0000 0000	Near end detection
2	0010 1000	0000 0000	0000 0011	0000 0000	Cover open
3	0000 1000	0000 0000	0000 0011	0000 0000	Cover closed

When the ASB status is received following this, a total of 8 bytes of ASB will be transmitted as follows.

Accumulated ASB (1+2+3)

	1st status	2nd status	3rd status	4th status
Accumulated ASB (1+2+3)	0010 1000	0000 0000	0000 0011	0000 0000
+	1st status	2nd status	3rd status	4th status
The latest ASB (3)	0000 1000	0000 0000	0000 0011	0000 0000

Notes on setting DIP switch 2-1 to ON

- ❑ The printer mechanism stops but does not become busy when an error has occurred, the cover is open, printing stops due to a paper end, or paper is fed using the PAPER FEED button.

- ❑ When setting DIP switch 2-1 to ON to enable handshaking with the printer, be sure to check the printer status using the **GS a** command and the ASB function. In this setting, the default value of *n* for **GS a** is 2. The printer automatically transmits the printer status, depending on on-line/off-line changes.

- ❑ When using **DLE EOT** and **DLE ENQ**, be sure that the receive buffer does not become full.

  - When using a host that cannot transmit data when the printer is busy and if an error occurs, **DLE EOT** and **DLE ENQ** cannot be used when the printer is busy due to a receive buffer-full state.

  - When using a host that can transmit data when the printer is busy and the receive buffer becomes full while transmitting bit-image data, a **DLE EOT** or **DLE ENQ** used while sending bit-image data is processed as bit-image data, not as a command. Secondly, any data transmitted when the receive buffer is full may be lost.

    Example: Check the printer status using **GS r** after transmitting each line of data and use the 4K byte receive buffer. Transmit one line of data so that the receive buffer does not become full.

RS-485 Serial Interface

Data transmission:	Serial
Synchronization:	Asynchronous
Handshaking:	Depend on the DIP switch settings (DTR/DSR or XON/XOFF control)
Signal levels:	2.0 V to 5.0 V: Logic 1 0.0 V to 0.8 V: Logic 0
Baud rates:	2400, 4800, 9600, 19200 bps
Data word lengths:	7 or 8 bits
Parity settings:	None, even, odd
Stop bits:	1 or more
Connector (printer side):	Female D-SUB25 pin connector

Notes:

- *The handshaking data word length, baud rate, and parity depend on the DIP switch settings.*
- *Data transmitted from the printer has 1 stop bit (fixed).*
- *DR1 > DR2 CS1 > CS2 indicates that:*

  Channel 1 is high.

  Channel 2 is low.

- *DR1 < DR2 CS1 < CS2 indicates that:*

  Channel 2 is high.

  Channel 1 is low.

Signal levels and communication control functions

CS1	CS2	Function
H	L	Communication is available
L	H	Communication is not available

If the electric potential of CS1 is higher than that of CS2, the printer is ready for communication (the host is ready to receive data). If the electric potential of CS1 is lower than that of CS2, the printer is not ready for communication (the host is not ready to receive data).

DR1	DR2	Function
H	L	Communication is available
L	H	Communication is not available

If the electric potential of DR1 is higher than that of DR2, the printer is ready for communication (the host is ready to receive data). If the electric potential of DR1 is lower than that of DR2, the printer is not ready for communication (the host is not ready to receive data).

Switching between on-line and off-line

The printer does not have an on-line/off-line switch.

The printer goes off-line:

- Between when the power is turned on (including reset using the interface) and when the printer is ready to recieve data.
- During the self-test.
- When the cover is open.
- During paper feeding using the paper feed button.

- When the printer stops printing due to a paper-end (in cases when an empty paper supply is detected by either the paper roll end detector or the paper roll near-end detector with a printing halt feature enabled due to paper shortage by ESC c 4).
- During macro executing standby status.
- When a temporary abnormality occurs in the power supply voltage.
- When an error has occured.

RS-485 interface connector pin assignments and functions

Pin number	Signal name	I/O	Function
1	FG	-	Frame ground
2	SD1	O	Transmit data
3	RD2	O	Transmit data
4	RD1	I	Receive data
5	RD2	I	Receive data

RS-485 interface connector pin assignments and functions (continued)

<table>
<tr><th>Pin number</th><th>Signal name</th><th>I/O</th><th>Function</th></tr>
<tr><td>7</td><td>SG</td><td>-</td><td>Signal ground</td></tr>
<tr><td>8</td><td>RD1</td><td>O</td><td>1) When DTR/DSR is selected, this signal indicates whether the host computer is BUSY or READY.
DR1 > DR2 indicates that the printer is READY and DR1 < DR2 indicates that the printer is BUSY. The BUSY condition can be changed depending on the off-line conditions set by the DIP switches. When the DTR/DSR control is selected, the printer becomes the BUSY state (DR1 < DR2) under the following conditions:
<table>
<tr><th colspan="2" rowspan="2">Printer status</th><th colspan="2">DIP SW 2-1 status</th></tr>
<tr><th>ON</th><th>OFF</th></tr>
<tr><td rowspan="8">Off-line</td><td>1. During the period from when the power is turned on (including resetting using the interface) to when the printer is ready to receive data.</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td>2. During the self-test</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td>3. When the cover is open.</td><td>-</td><td>BUSY</td></tr>
<tr><td>4. During paper feeding using the paper feed button.</td><td>-</td><td>BUSY</td></tr>
<tr><td>5. When the printer stops printing due to a paper-end.</td><td>-</td><td>BUSY</td></tr>
<tr><td>6. During macro executing standby status.</td><td>-</td><td>BUSY</td></tr>
<tr><td>7. When a temporary abnormality occurs in the power supply voltage.</td><td>-</td><td>BUSY</td></tr>
<tr><td>8. When an error has occurred.</td><td>-</td><td>BUSY</td></tr>
<tr><td></td><td>9. When the receive buffer becomes full.</td><td>BUSY</td><td>BUSY</td></tr>
</table>
2) When XON/XOFF control is selected:
This signal indicates whether the printer is correctly connected and is ready to receive data. DR1 > DR2 (READY) indicates that the printer is ready to receive data. The signal is always DR1 > DR2 except in the following cases:
❑ During the period after the power is turned on until the printer is ready to receive data.
❑ During the self test.</td></tr>
<tr><td>10
11</td><td>CS 1
CS 2</td><td>I</td><td>This signal indicates whether the host computer is BUSY or READY.
CS1 > CS2 indicates that the printer is READY and CS1 < CS2 indicates that the printer is BUSY.
1) When DTR/DSR is selected:
The signal is checked and data is transmitted only when the host is ready to receive data (READY) (except for transmitted by DLE EOT or GS a).
2) When XON/XOFF control is selected:
Transmits data regardless of the status of this signal.</td></tr>
</table>

Notes:

- *When the remaining space in the receive buffer drops to 16 bytes, the printer status becomes "buffer full" and it remains "buffer full" until the space in the receive buffer increases to 26 bytes.*
- *The printer ignores the data received when the remaining space in the receive buffer is 0 bytes..*

XON/XOFF Transmit Timing

When XON/XOFF control is selected by the DIP switch, the printer transmits XON/OFF to the host according the table below. Transmit timing differs depending on the DIP SW 2-1 setting.

XON/XOFF transmit timing

Printer status		DIP SW 2-1 status	
		ON	OFF
XON transmission	• When the printer goes on line after turning on the power or reset using interface.	Transmission	Transmission
	• When the receive buffer is released from the buffer full state.†	Transmission	Transmission
	• When the printer switches from off line to on line (*1).	-	Transmission
	• When the printer recovers from an error through a command.	-	Transmission
XOFF transmission	• When the receive buffer becomes full.	Transmission	Transmission
	• When the printer switches from on line to off line (*2).	Transmission	Transmission

(*1) XON is not transmitted when the receive buffer is full.

(*2) XOFF is not transmitted when the receive buffer is full.

Note:
The XON code is <11>H and the XOFF code is <13>H.

Data Format When Using RS-485

Transmission data (8 bits, none parity)

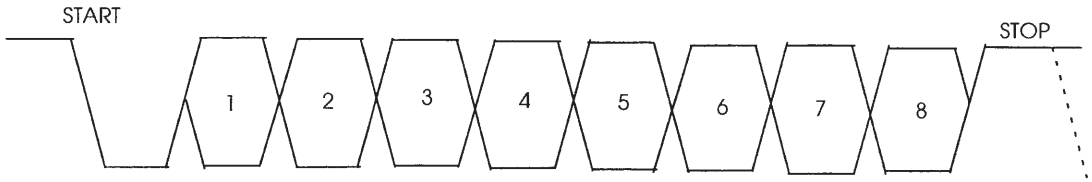


Figure A-1 S-485 Communication data format

"H" indicates:

<Printer transmission data> SD1 < SD2

<Printer reception data> RD1 < RD2

"L" indicates:

<Printer transmission data> SD1 > SD2

<Printer reception data> RD1 > RD2

The transmission data is H = 1, L = 0

Note:
This format is used when the UART for RS-232 is connected to the RS-485 driver.

Printer reception data level

RD1	RD2	Read data
H	L	Receiving data line is low level
L	H	Receiving data line is high level

Printer transmission data level

SD1	SD2	Send data
H	L	Sending data line is low level
L	H	Sending data line is high level

Main Circuit Board Unit-A Parts Layout (parts side) Part No. 202254500

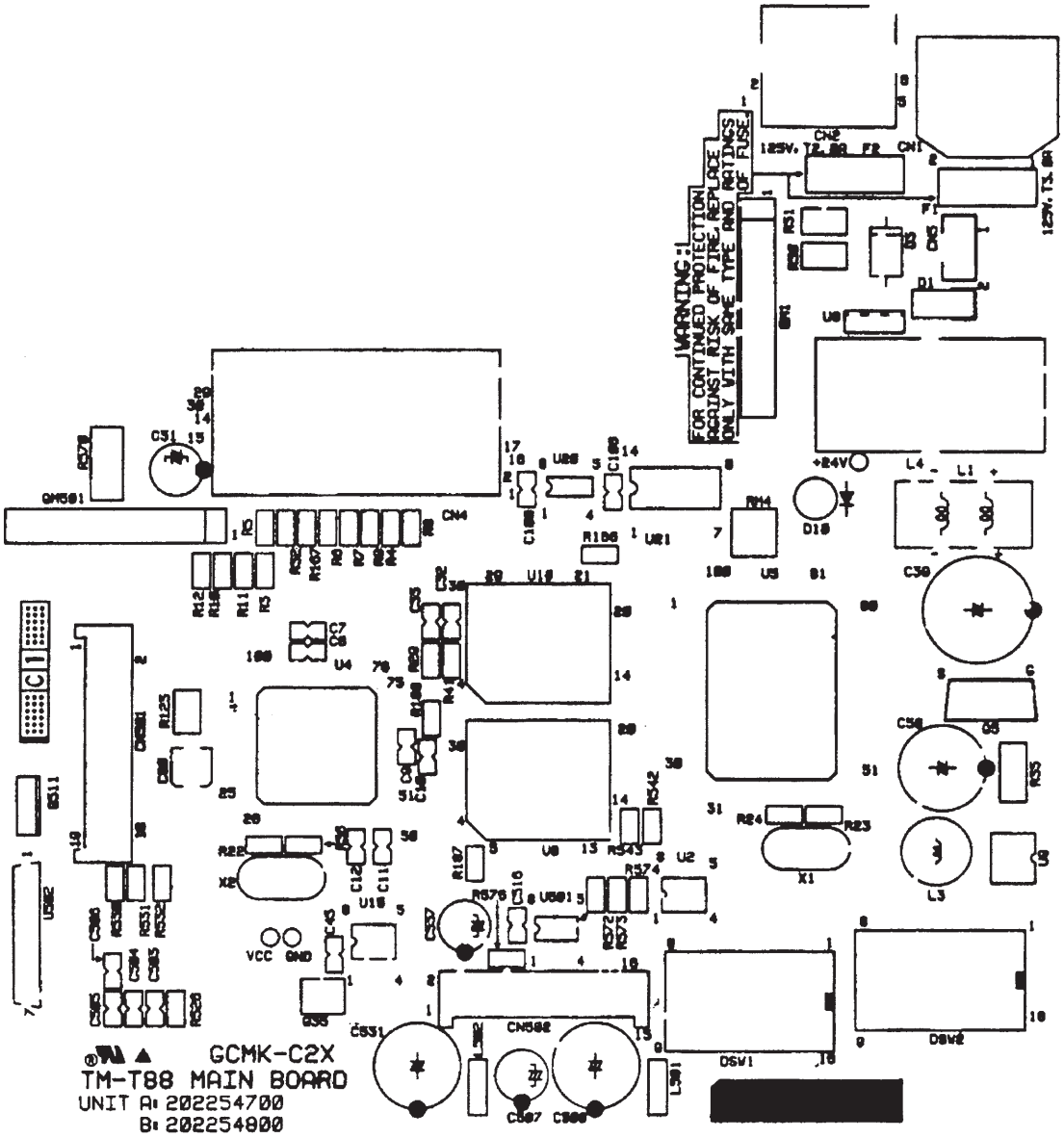
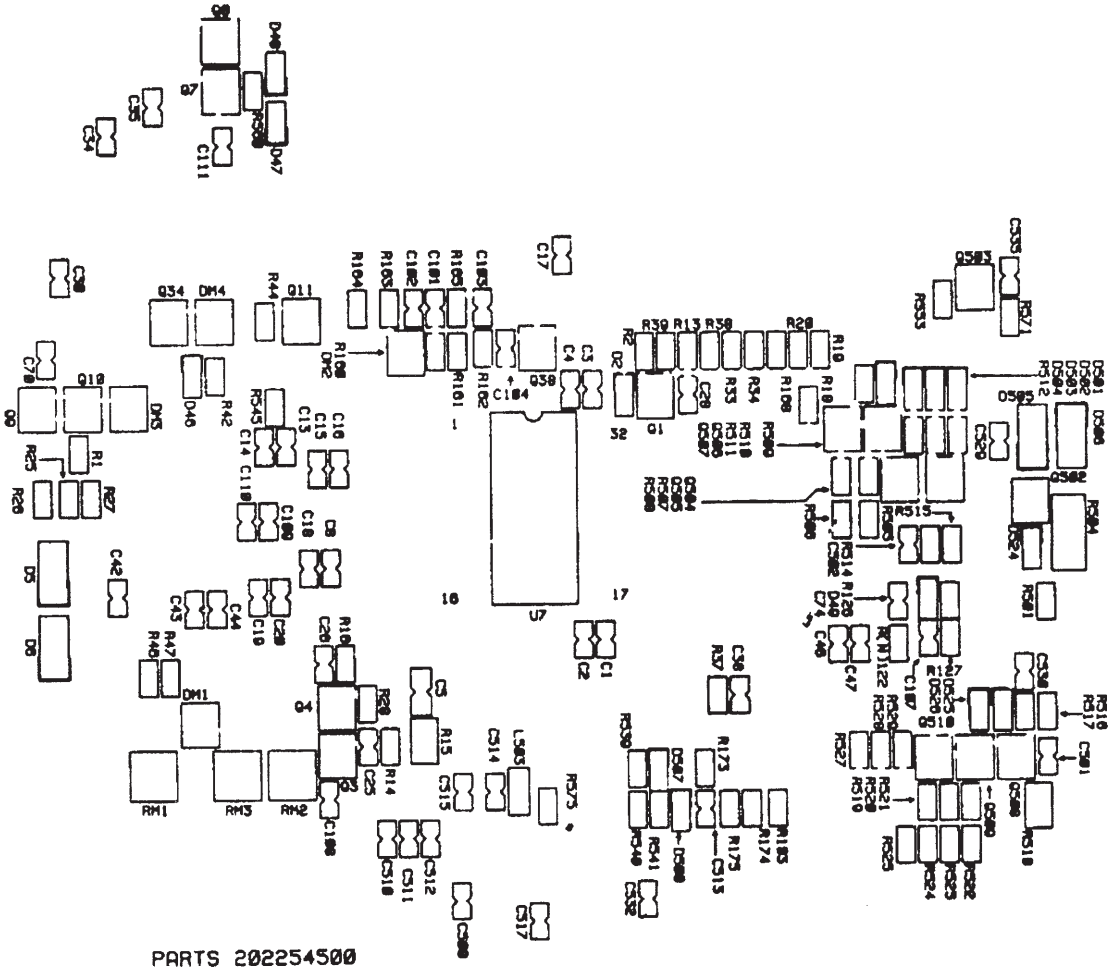
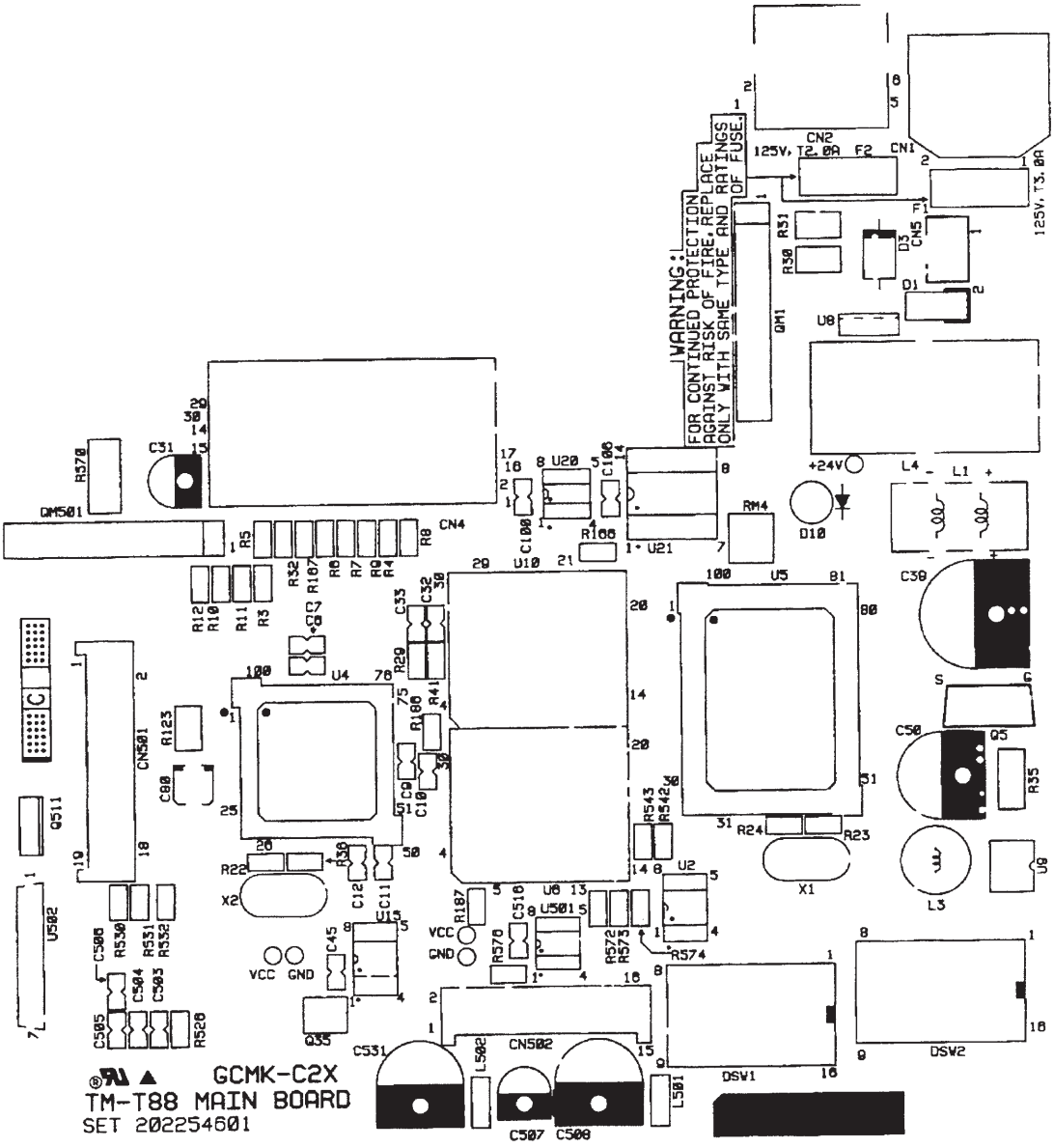


Figure A-2

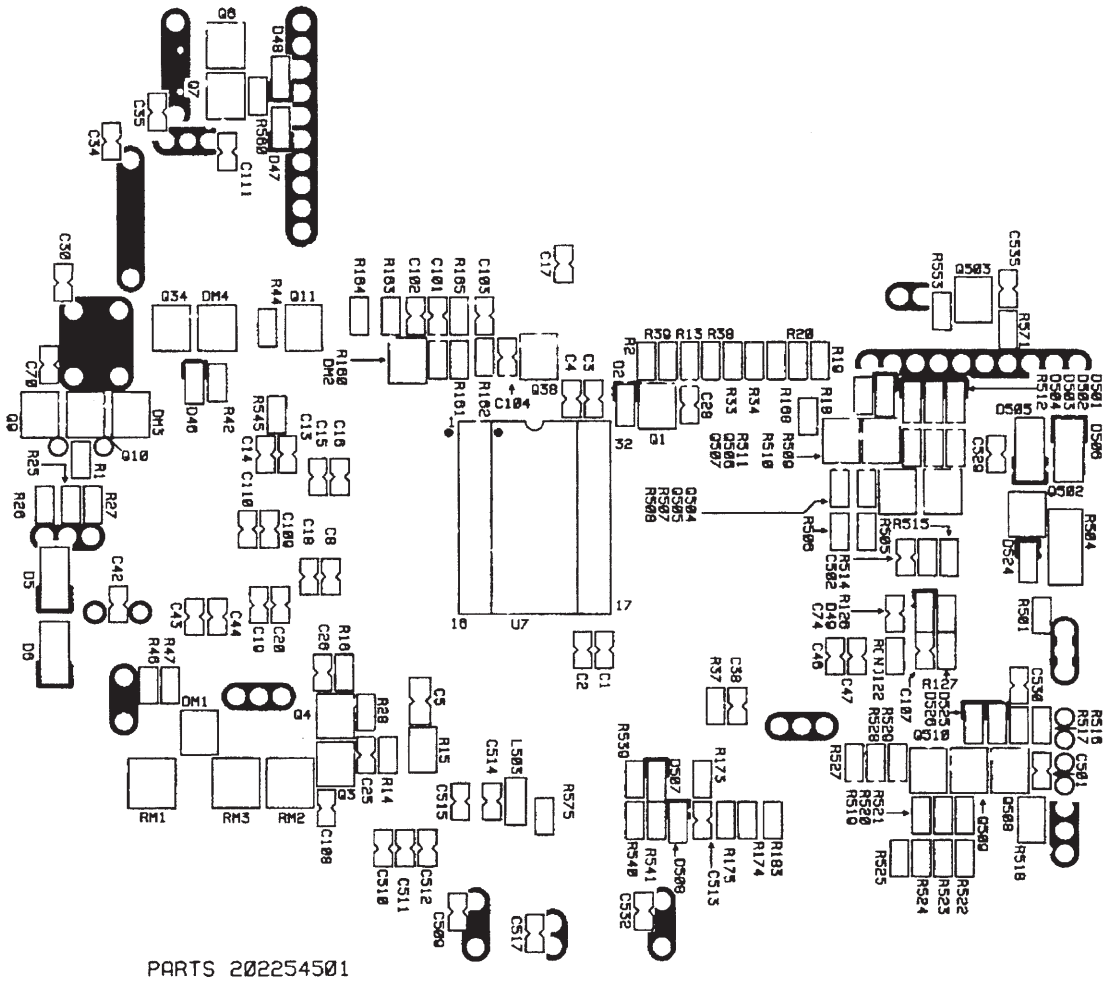
Main Circuit Board Unit-A Parts Layout (solder side) Part No. 202254500



Main Circuit Board Unit-A Parts Layout (parts side) Part No. 202254501



Main Circuit Board Unit-A Parts Layout (solder side) Part No. 202254501



RS-232 Serial Interface Circuit Board Parts Layout

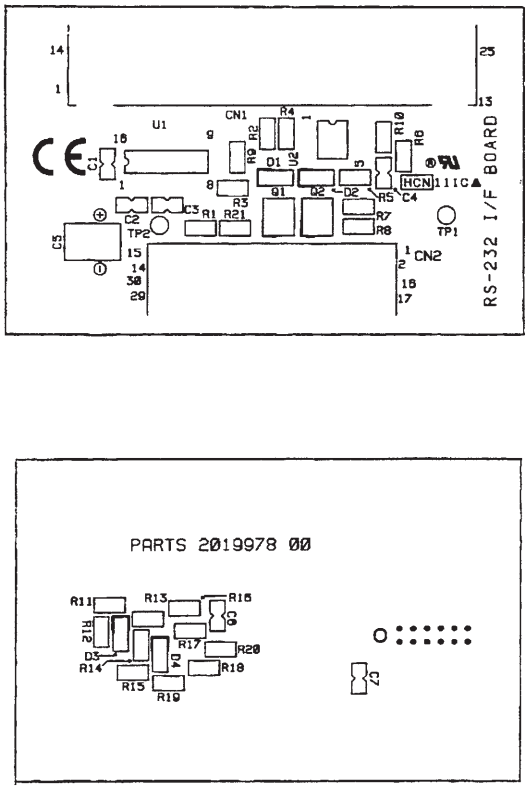


Figure A-3

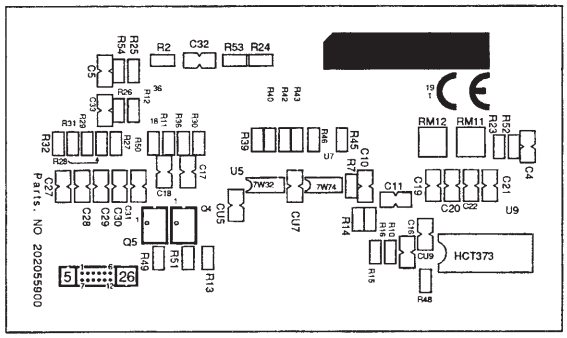


Figure A-4

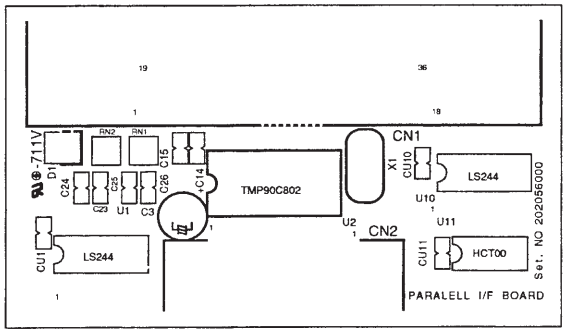


Figure A-5

RS-485 Serial Interface Circuit Board Parts Layout

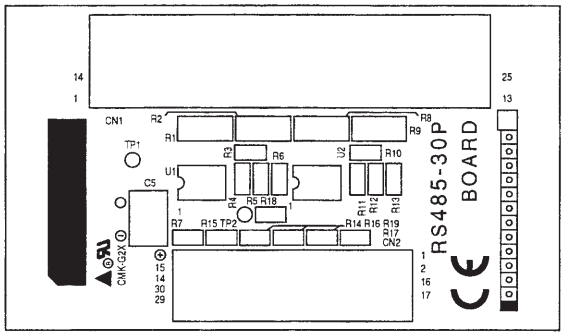


Figure A-6

Switch Circuit Board Assembly-B

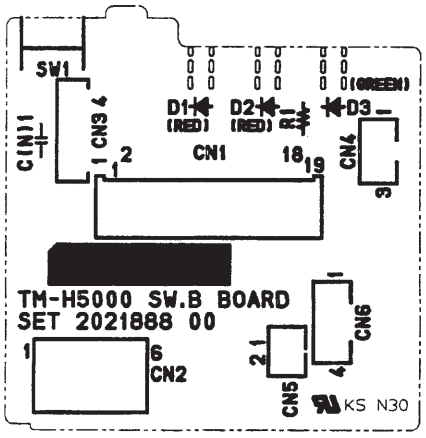


Figure A-7

Case Unit Parts Name List

Case unit parts List

Ref. #	Part Name	Note
100	CC M3x4	
101	cover-thermal-AA	
200	CCS-tite M3x8	
201	IC cover	
300	CCS-tite M3x8	
301	case-thermal-upper-AA	
302	switch panel -BA	
400	cover-cutter-AA	
500	CC M3x4	
501	FFC-B	
502	power switch assembly-C	
600	case-lower-AA	
601	rubber foot Y24N5	
700	CPS-tite (O) M3x6	
701	mechanism assembly-B-M-T88	
702	plate-mechanism	
800	CPS-tite (O) M3x6	
801	CPS-tite (O) M3x6	
802	main circuit board unit-A	
803	plate-circuit board	
804	plate-rear	
805	seal-caution	
806	seal-waterproof	
900	hexagon screws CPS-tite M3x6	for serial interface for parallel interface
901	I/F circuit board assembly	
902	plate-connector-AA plate-connector-BA	for serial interface for parallel interface

Note: "Assembly" may be abbreviated "ass'y" in some parts lists.

M-T88 Printer Mechanism Parts Name List

M-T88 Printer Mechanism Parts Name List

Ref. #	Part Name	Note
100	CBS-tite M3x5	
101	switch circuit board assembly-B	
200	RE 2.0	
201	shaft-cover	
202	spring-shutter	
203	CBS-tite M3x5	
204	cover-roll paper	
205	label-handling-BA	
206	fixed blade	
207	spring-fixed blade holders	
208	RE 2.5	
209	platen assembly	
210	shaft holder-platen	
211	cover-frame	
300	CBS-tite M3x5	
301	CB M2x2.5	
302	emergency cutter	
303	label-handling-BB	
304	CBS-tite M3x5	
305	cover-paper cutter assembly	
306	CB M2x2.5	
307	motor-paper cutter sub-assembly	
308	screw-switch	
309	microswitch MLS-1Aus	
310	shield tube	
311	guard tube	
312	lead wire-paper cutter	
313	frame-paper cutter	
400	CBB-tite M2x8	
401	microswitch D2A-1120	
402	lever-N.E. detector	
403	holder-N.E. detector	
404	RE 1.5	

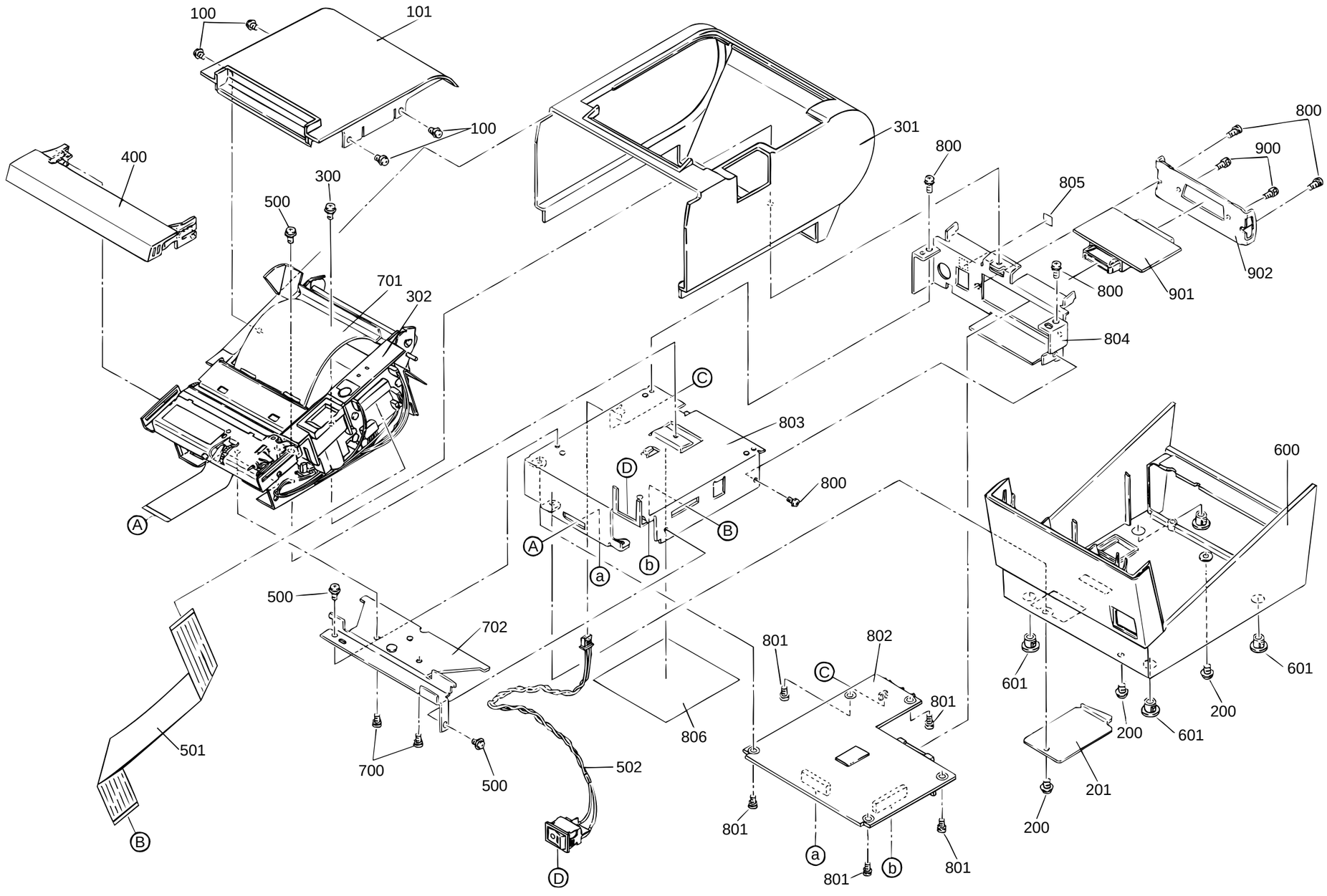
M-T88 Printer Mechanism Parts Name List

Ref. #	Part Name	Note
405	screw-detector adjustment	
406	hexagon nut M3	
407	lead wire-N.E. detector	
500	CBS-tite M3x5	
501	plate-shield	
502	paper detector assembly	
503	button-open	
504	spring-button	
505	paper guide	
600	RE 2.5	
601	lever-cover open	
602	lead wire-cover open detector	
603	detector circuit board assembly-A	
604	CBS-tite M3x5	
700	CBS-tite M3x5	
701	strengthen plate-frame	
702	plate-spring press	
703	spring-press head	
704	thermal head	
705	FFC	
800	RE 2.5	
801	gear-deceleration	
802	CBS-tite M3x5	
803	motor-paper feed-receipt	
900	CBS-tite M3x5	
901	spring-cover	
902	frame assembly	
903	CBS-tite M3x5	

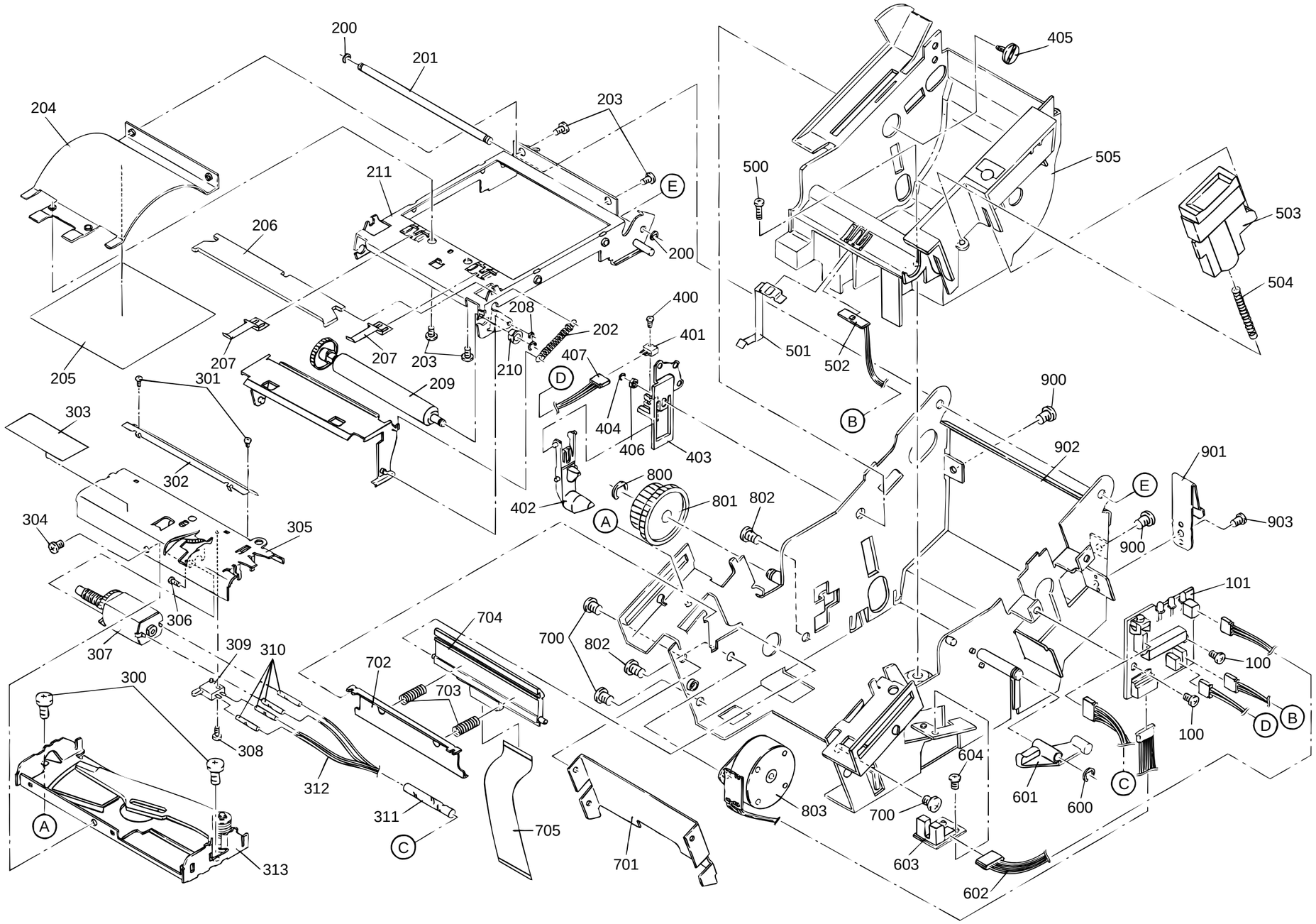
Note: "Assembly" may be abbreviated "ass'y" in some parts lists.

Overall Exploded diagram

Case Unit

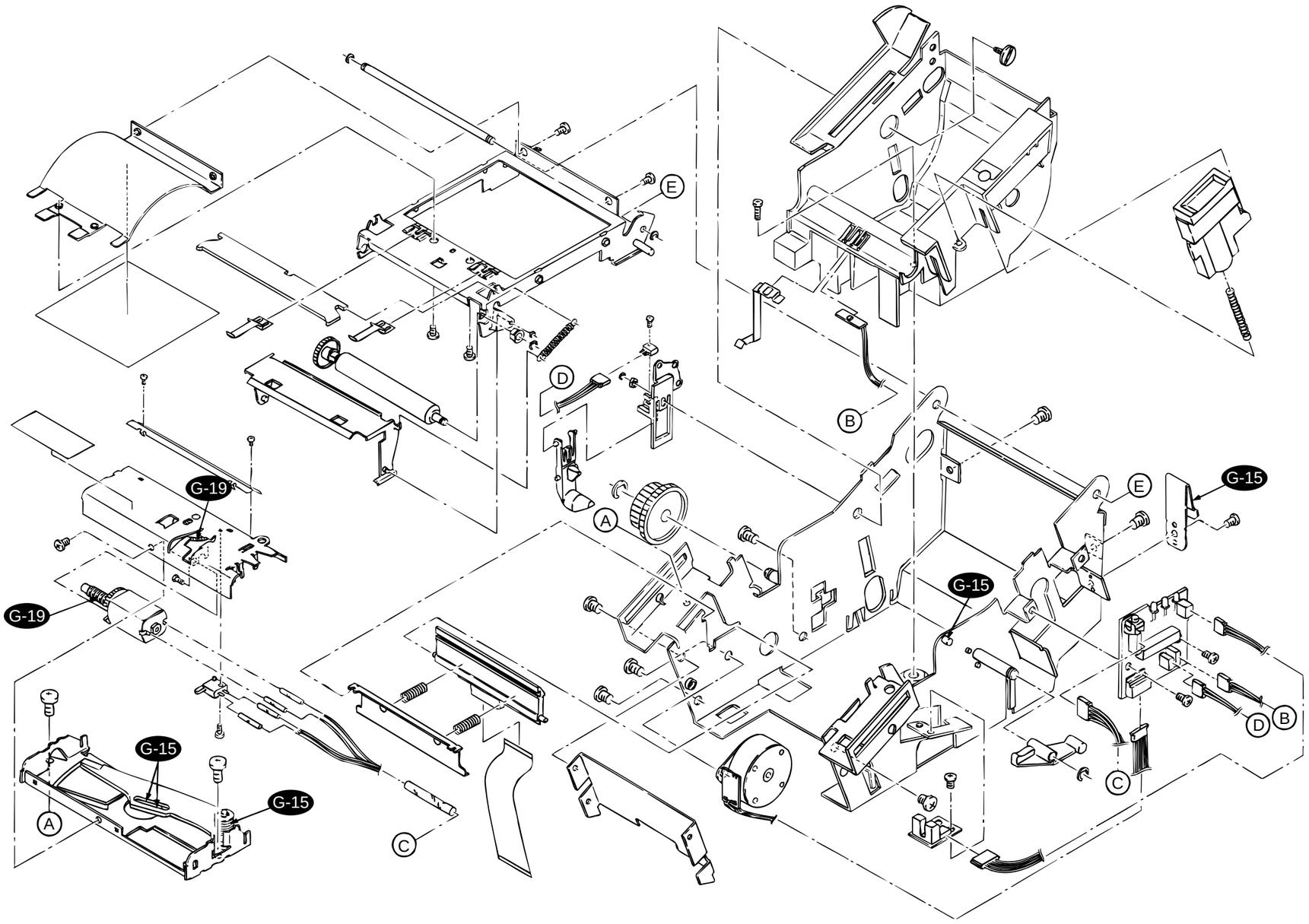


M-T88 Printer Mechanism



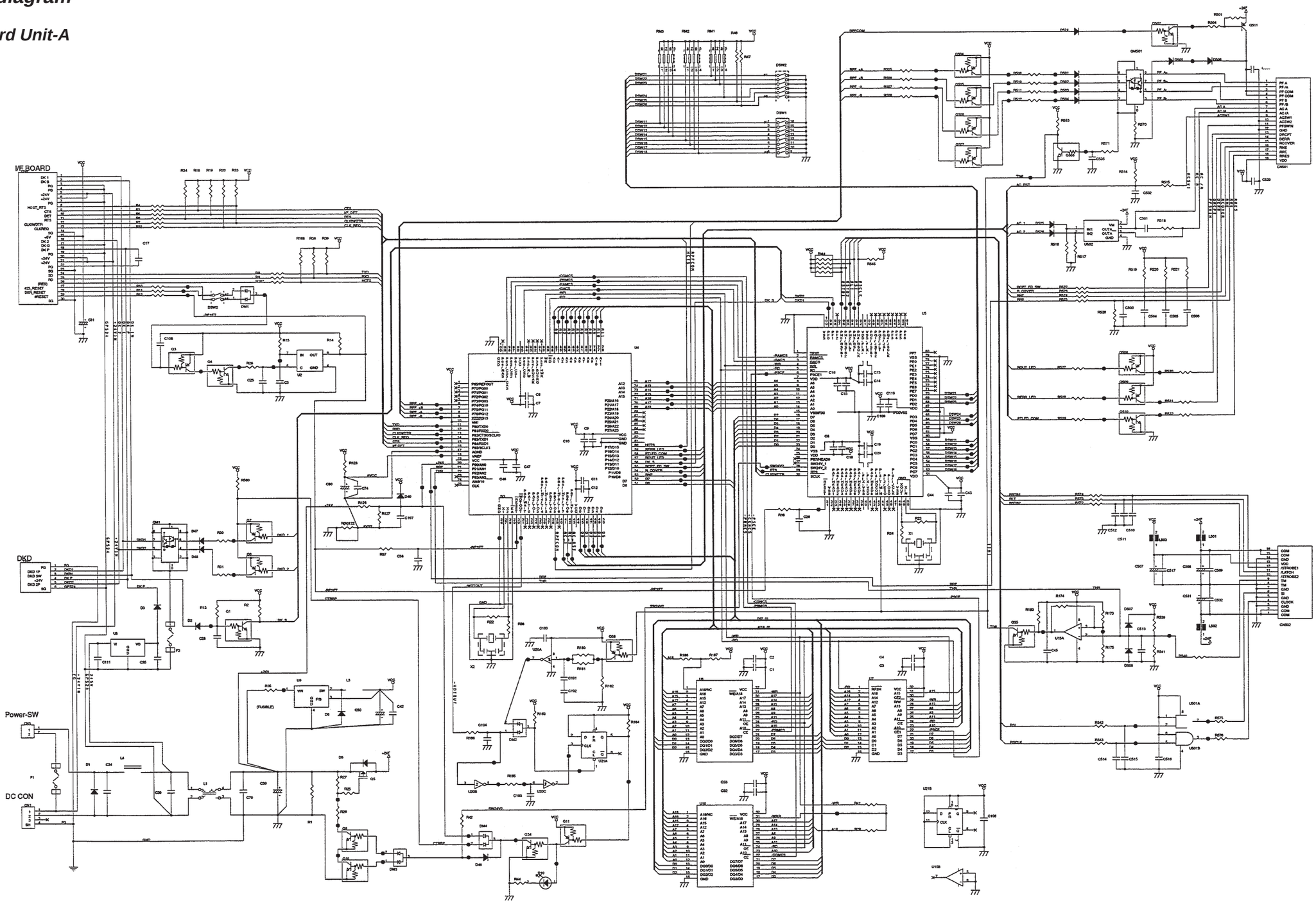
Lubrication Points Diagram

M-T88 Printer Mechanism

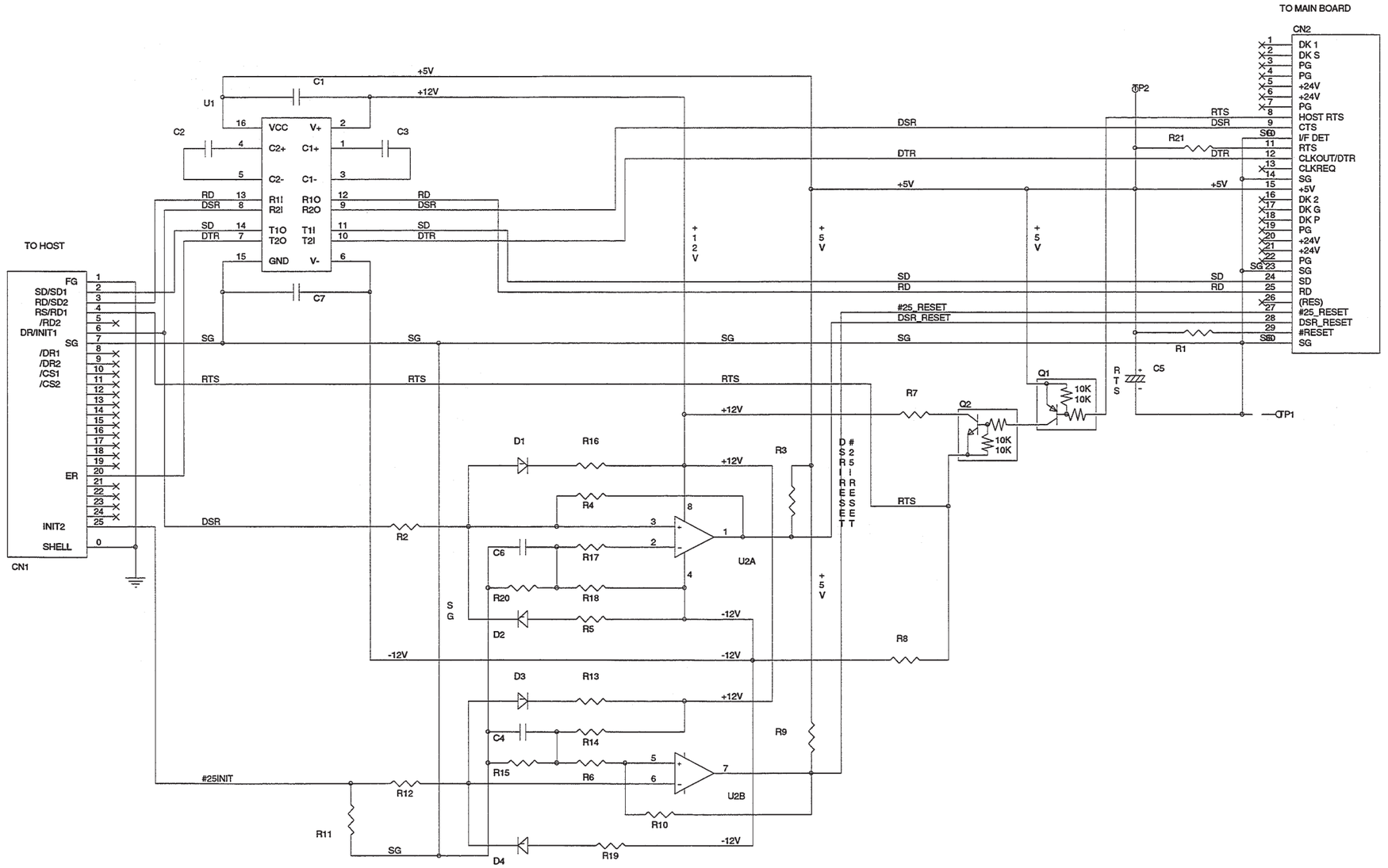


Circuit Board diagram

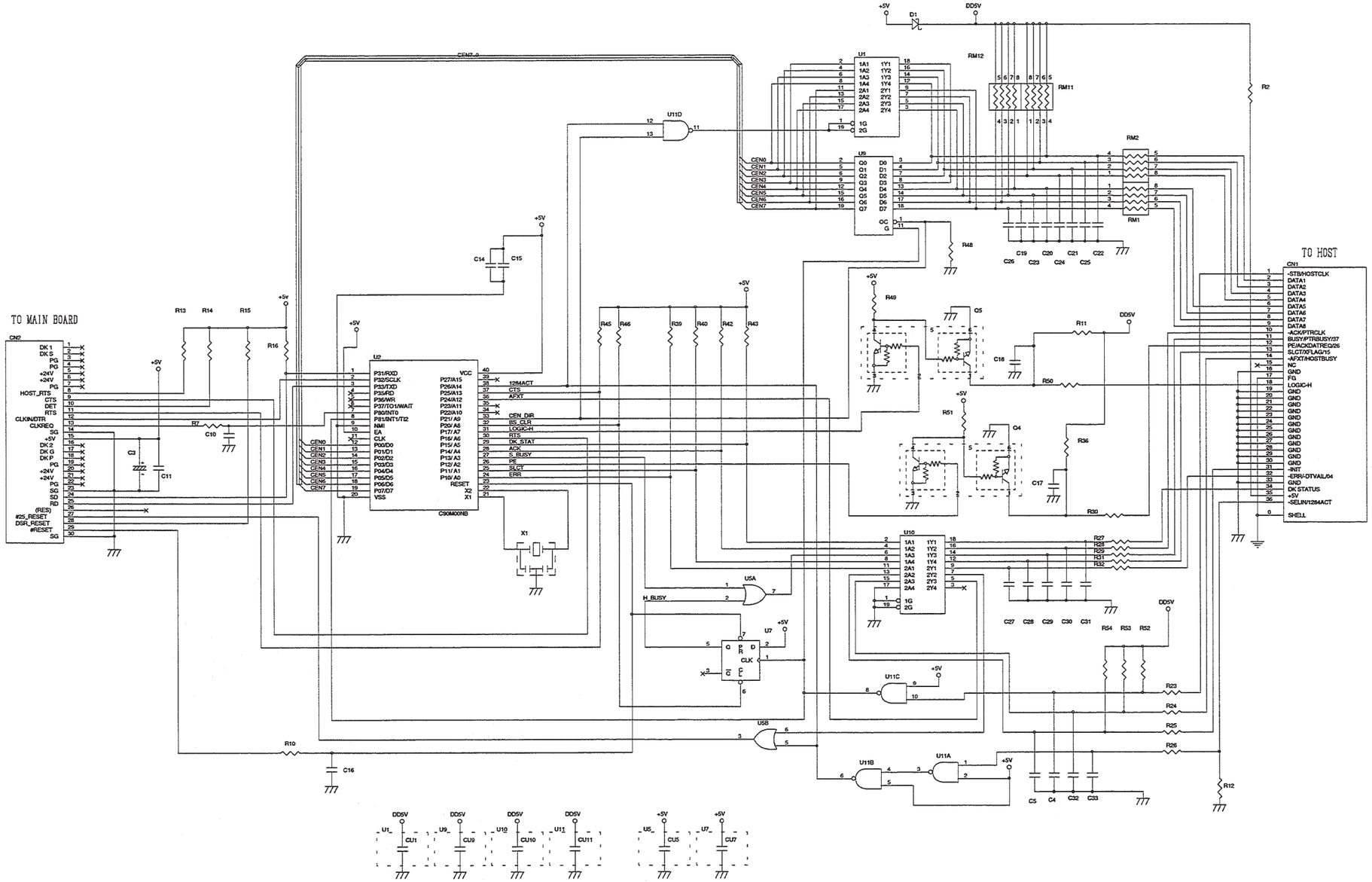
Main Circuit Board Unit-A



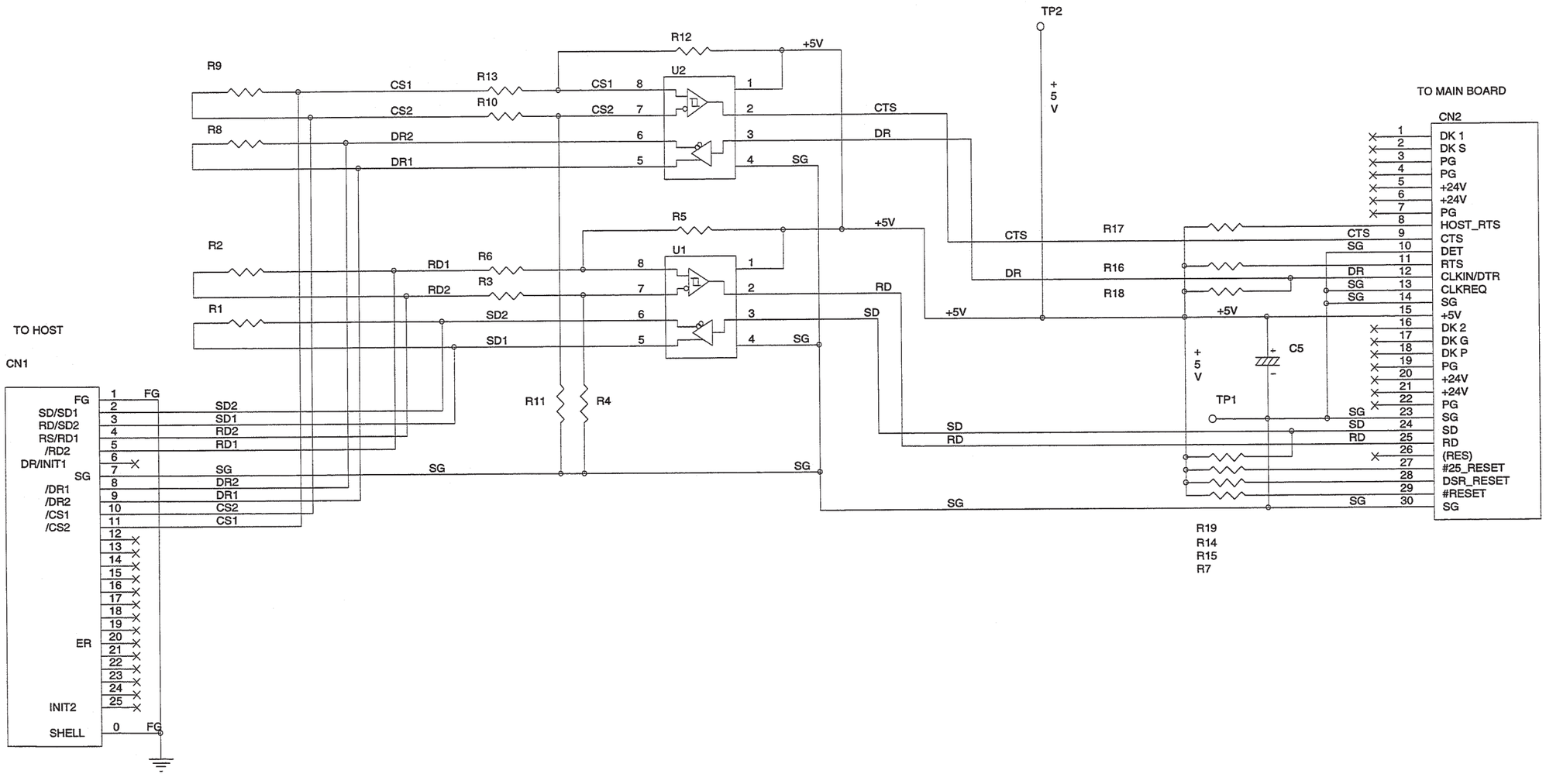
RS-232 Interface Board



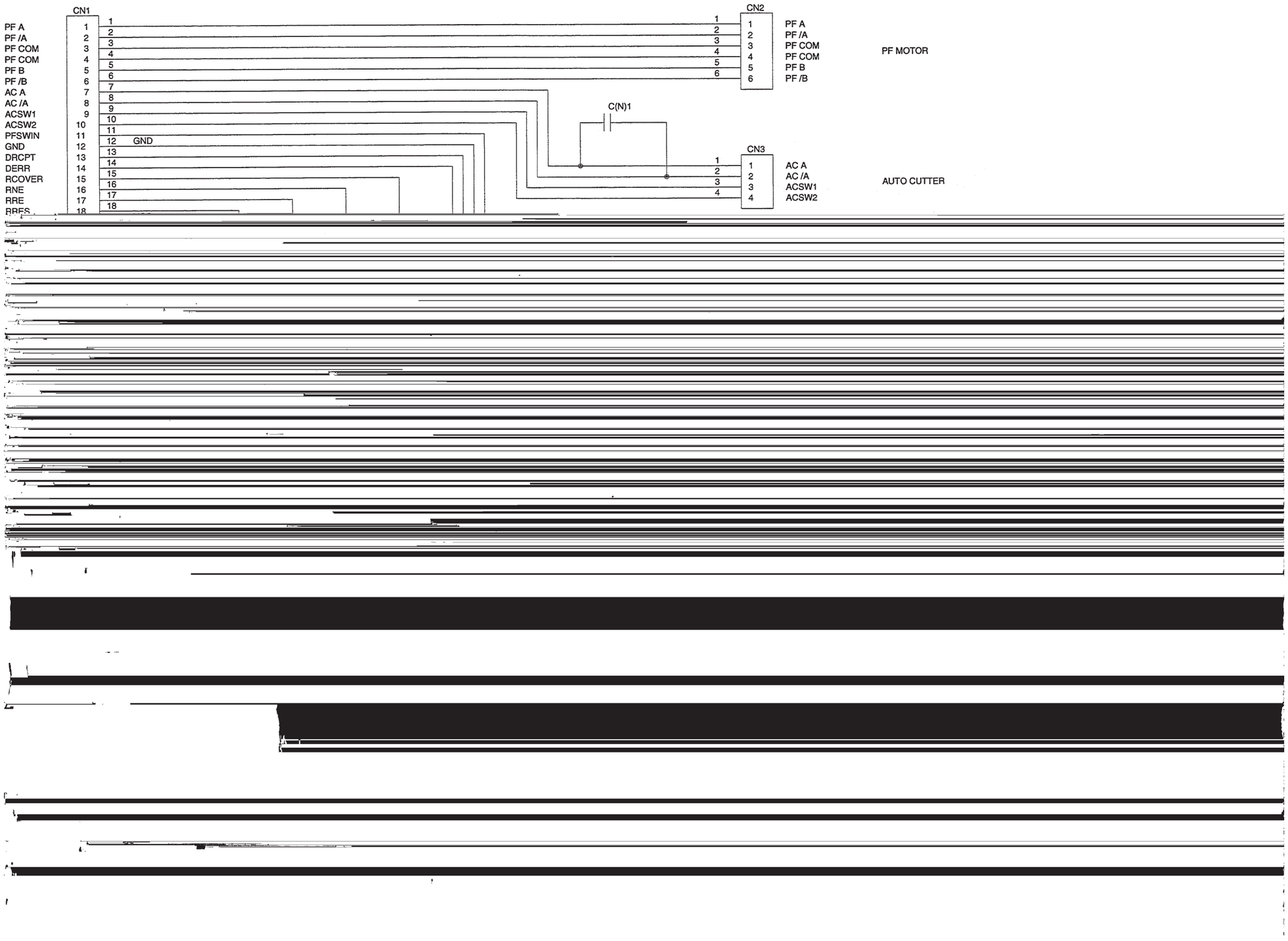
IEEE 1284 Interface

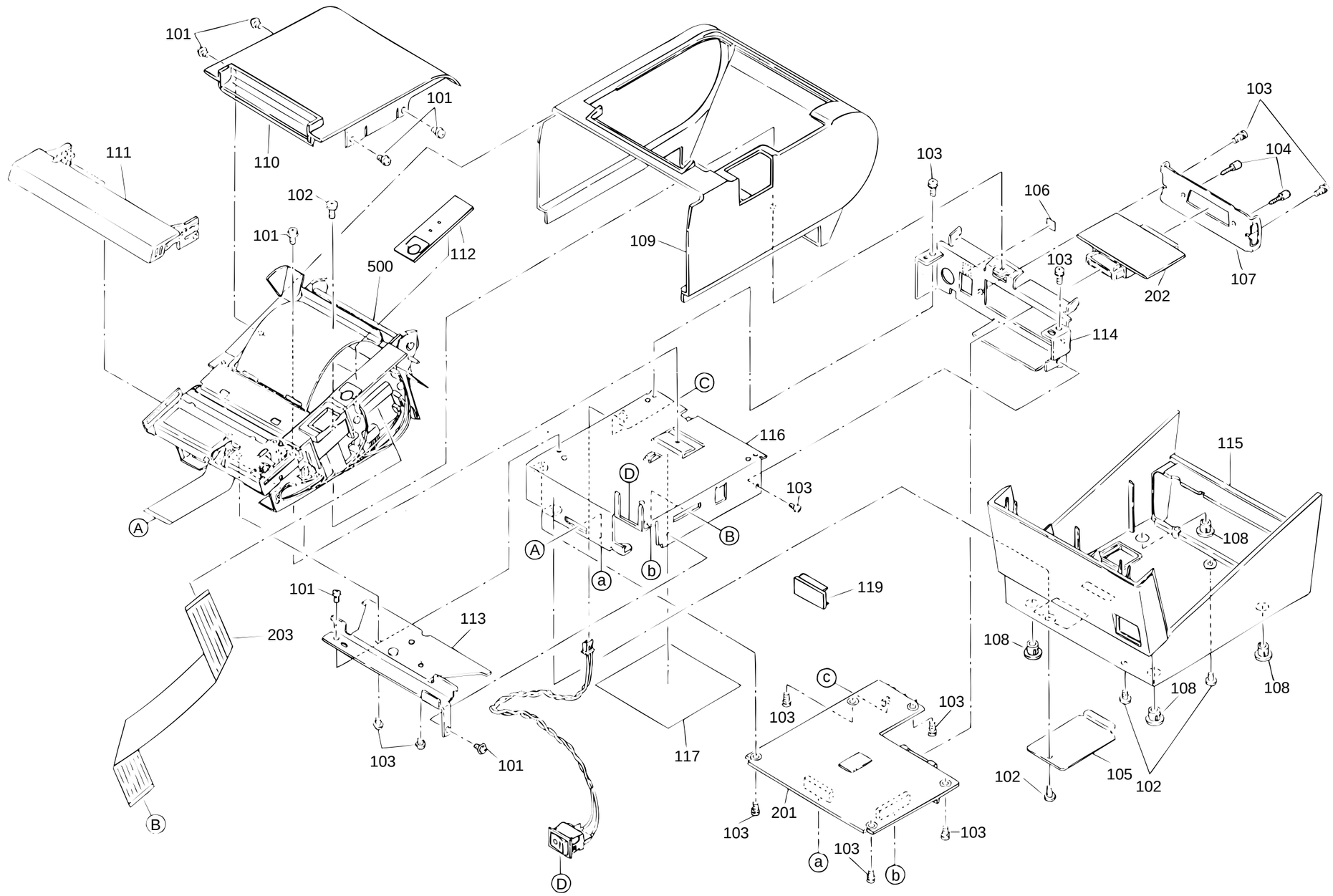


RS-485 Interface Board



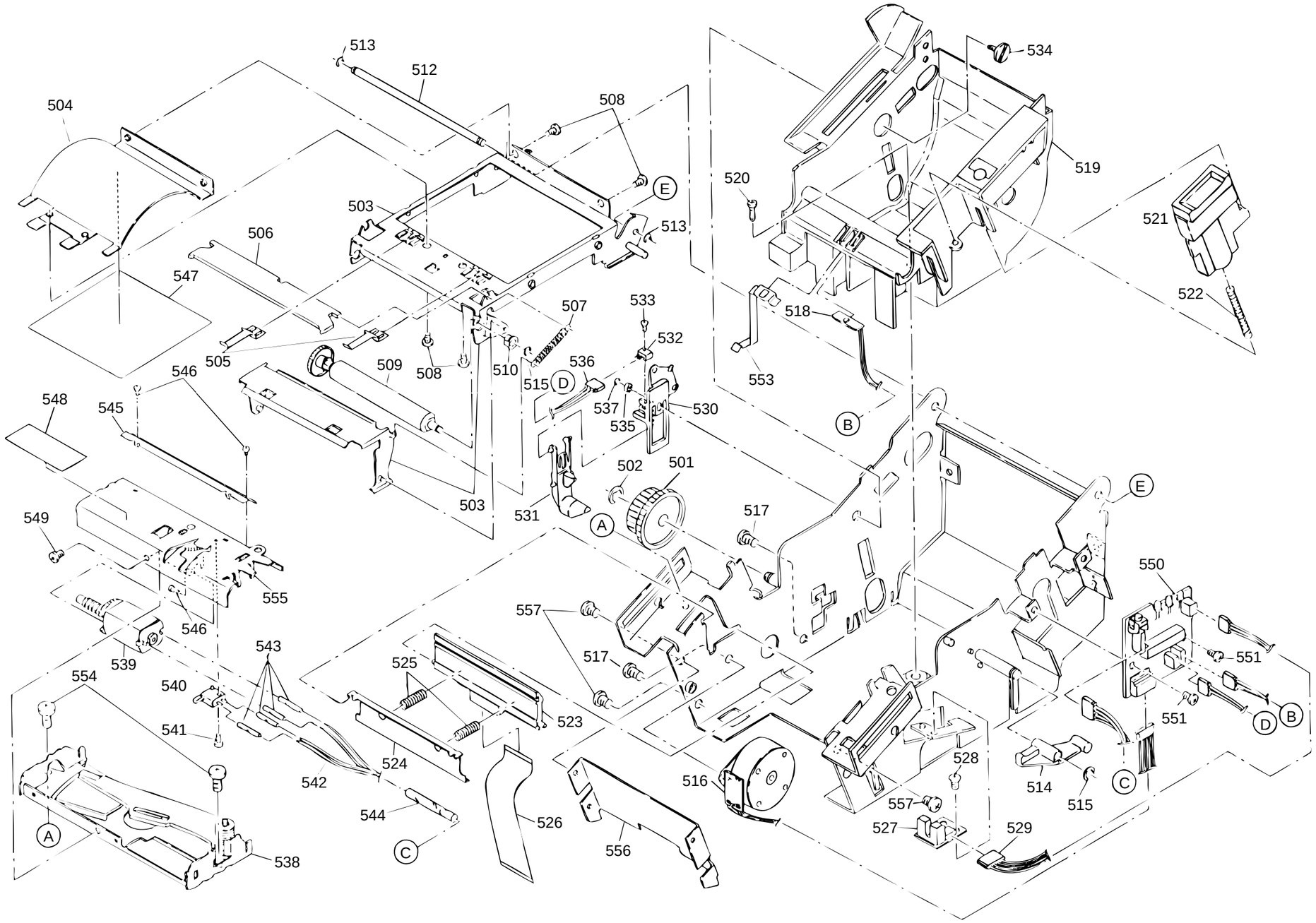
Switch Circuit Board Assembly-B





"The exploded diagram is made based on the standard specification of our company.
When the part or unit indifferent from your specification is shown in the diagram,
please disregard it."

EXPLODED DIAGRAM FOR TM-T88 NO.1



"The exploded diagram is made based on the standard specification of our company.
When the part or unit indifferent from your specification is shown in the diagram,
please disregard it."

EXPLODED DIAGRAM FOR TM-T88 NO.2

PARTS LIST

Item	Code No.	Parts Name	Specification	Q	R
	CASE BLOCK				
101	1903 1519	Cup screw M3x4	B040302311	7	X
102	1906 4062	C.C.S. screw M3x8	B300304311	4	X
103	1906 2109	C.P.S. (0) screw M3x6	B302404211	12	X
104	1906 2119	Hexagon nut MM	X610220000	2	X
104	1906 2120	Hexagon screw (inch)	X610220010	2	X
105	1906 3141	IC cover	1006007	1	C
106	1906 2126	Seal, Caution	1023411	1	X
107	1906 3142	Plate, Connector, AA	1026516	1	X
108	1906 3143	Rubber foot	1026525	4	X
109	1906 3144	Case, Thermal, Upper, AA	1029474	1	X
110	1906 3145	Cover, Thermal, AA	1029475	1	C
111	1906 3146	Cover, Cutter, AA	1029476	1	C
112	1906 3147	Switch panel, BA	1029719	1	C
113	1906 3148	Plate, Mechanism	1030259	1	X
114	1906 3149	Plate, Rear	1030260	1	X
115	1906 3150	Case, Lower, AA	1030261	1	X
116	1906 3151	Frame, Circuit board	1030286	1	X
117	1906 3152	Sheet, Water-proof	1032632	1	X
119	1906 3153	Cover, Power switch, AA	1027278	1	C
	CONTROL BOARD BLOCK				
201	1906 3154	Main circuit board unit B	2022548	1	A
CN1	1906 2133	Connector 3P	X600570300	1	C
CN2	1906 2132	Connector 6,1.02mm	2014486	1	C
CN4	1906 3155	Connector 30,1.27mm	2019963	1	C
CN5	1906 2129	Connector 2P	X600720201	1	C
CN501	1906 3156	Connector 19P	2022624	1	C
CN502	1906 3157	Connector 16P	2022623	1	C
DSW1,DSW2	1906 2137	DIP switch	2014388	2	C
F1	1906 3158	Fuse 125V,3A	2018738	1	A
F2	1906 3159	Fuse 125V,2A	2017325	1	A
QM1,QM501	1906 2145	Transistor array	2004446	2	B
Q5	1906 3160	P-CH FET	2015765	1	B
U15	1906 2172	Comparator (IC)	2012489	1	A
U2	1906 2169	Reset IC	2003700	1	A
U20	1906 3161	C-MOS IC	2013708	1	A
U21	1906 3162	C-MOS IC	X462707409	1	A
U4	1906 3163	Microcontroller (LSI)	2018215	1	A
U5	1906 3164	Gate array	2021896	1	A
U501	1906 3165	C-MOS IC	X461600808	1	A
U502	1906 2167	Transistor array	2003595	1	A
U8	1906 2153	Voltage regurator IC	2014222	1	A
202	1906 3166	RS-232C I/F board ass'y A	2019979	1	A
203	1906 3167	FFC cable B	2022015	1	A
	PRINTER MECHANISM BLOCK				
500	1906 3168	Mechanism ass'y, BA	1029714	1	A
501	1906 3169	Gear, Deceleration	1029350	1	B
502	1909 2805	Retaining ring Type-E(2.5)	1004399	1	X
503	1906 3170	Cover, Frame ass'y	1031455	1	X
504	1906 3171	Cover, Roll paper	1029788	1	C
505	1906 3172	Spring, Fixed blade holder	1029375	2	C

Notes: Q – Quantity used per unit
R – Rank

R – A : Essential
B : Stock recommended
C : Others
X : No stock recommended

Item	Code No.	Parts Name	Specification	Q	R
506	1906 3173	Fixed blade	1029366	1	B
507	1906 3174	Spring, Shutter	1029356	1	A
508	1908 7657	C.B.S. screw M3x5	B300204111	4	X
509	1906 3175	Platen ass'y	1031131	1	A
510	1906 3176	Shaft holder, Platen	1005775	1	X
512	1906 3177	Shaft, Cover	1029349	1	X
513	1909 1896	Retaining ring Type-E(2.5)	B150300411	2	X
514	1906 3178	Lever, Cover open	1029357	1	C
515	1909 2805	Retaining ring Type-E(2.5)	1004399	2	X
516	1906 3179	Motor, Paper feed, Receipt	2021867	1	A
517	1908 7657	C.B.S. screw M3x5	B300204111	2	X
518	1906 3180	Paper detector ass'y	1029385	1	A
519	1906 3181	Paper guide	1029362	1	C
520	1908 7657	C.B.S. screw M3x5	B300204111	1	X
521	1906 3182	Button, Open	1029793	1	C
522	1906 3183	Spring, Button	1029794	1	B
523	1906 3184	Thermal head unit	1030681	1	A
524	1906 3185	Plate, Spring press	1029360	1	X
525	1906 3186	Spring, Press head	1029359	2	A
526	1906 3187	FFC cable	2021868	1	A
527	1906 3188	Detector circuit biard ass'y A	2014343	1	A
528	1908 7657	C.B.S. screw M3x5	B300204111	1	X
529	1906 3189	Lead wire, Cover open detector	2021873	1	C
530	1906 3190	Holder, N.E. detector	1029377	1	X
531	1906 3191	Lever, N.E. detector	1029378	1	X
532	1906 3192	Micro-switch	2014923	1	A
533	1906 2115	C.B.B-tite screw 2x8	1017753	1	X
534	1906 3193	Screw, detector adjustment	1029379	1	C
535	1903 0711	Hexagon nut M3	B070100311	1	X
536	1906 3194	Lead wire, N.E. detector	2021872	1	C
537	1906 2256	Retaining ring Type-E(1.5)	B150300314	1	X
538	1906 3195	Frame, Paper cutter ass'y	1029833	1	X
539	1906 3196	Motor, paper cutter sub ass'y	1029921	1	A
540	1906 3197	Micro-switch	2021866	1	A
541	1906 3198	Screw, Switch	1030332	1	X
542	1906 3199	Lead wire, Paper cutter	2021871	1	C
543	1909 2858	Shield tube	F201508030	4	X
544	1906 3200	Guard tube	F201509010	1	X
545	1906 3201	Emergency cutter	1029836	1	B
546	1906 3202	C.B. screw 2x2.5, F/ZN	1006769	3	X
547	1906 3203	Label, Holding, BA	1029823	1	X
548	1906 3204	Label, Holding, BB	1029824	1	X
549	1908 7657	C.B.B. screw M3x5	B300204111	1	X
550	1906 3205	Switch circuit board ass'y B	2021888	1	A
551	1908 7657	C.B.S. screw M3x5	B300204111	2	C
553	1906 3206	Plate, Shield	1030695	1	X
554	1908 7657	C.B.S. screw M3x5	B300204111	2	X
555	1906 3207	Cover, Paper cutter ass'y	1031132	1	X
556	1906 3208	Reinforce plate, Frame	1031331	1	X
557	1908 7657	C.B.S. screw M3x5	B300204111	3	X

Notes: Q – Quantity used per unit
R – Rank

R – A : Essential
B : Stock recommended
C : Others
X : No stock recommended

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